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Scientific and Technical Aerospace Reports

A SEMIMONTHLY ABSTRACT JOURNAL WITH INDEXES

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VOLUME 11 • NUMBER 11

N73-19992—N73-20994

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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Scientific and Technical Aerospace Reports, Volume 11, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Informatics Tisco, Inc.

The Administrator of the National Aeronautics and Space Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through April 1, 1974.

INTRODUCTION

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The authority for the indexing vocabulary used in the subject index of this issue of *STAR* is the *NASA Thesaurus*. The most recent version is the *NASA Thesaurus— Alphabetical Update* (NASA SP-7040), September 1971, which is available from NTIS as accession number N72-15923 for $6.00 in paper copy. The current cross-reference structuring for each term appears in this volume, together with additional approved terms that may be used in indexing documents announced in other issues of *STAR*. NASA SP-7040 supersedes the first two volumes (subject terms A–Z) of the three-volume *Preliminary Edition of the NASA Thesaurus* (NASA SP-7030), December 1967. Volume III of the Preliminary Edition presented the following aids to vocabulary selection of the 1967 terms: hierarchical display of index terms, category terms listing, and permuted index; this has not been updated but may still be useful.

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31 Space Vehicles 1340
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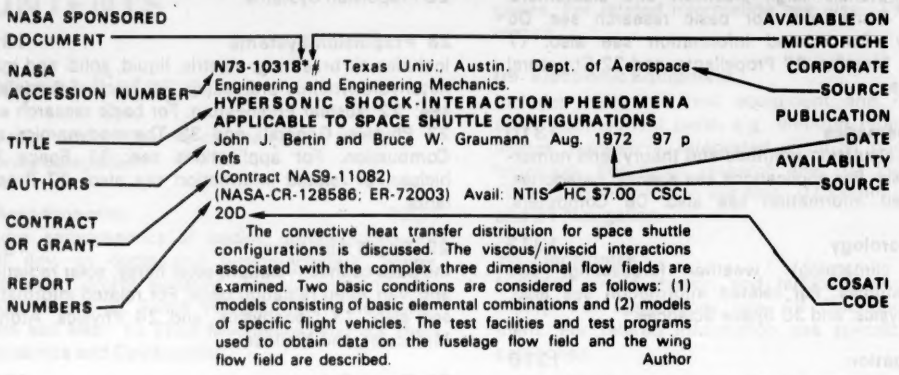
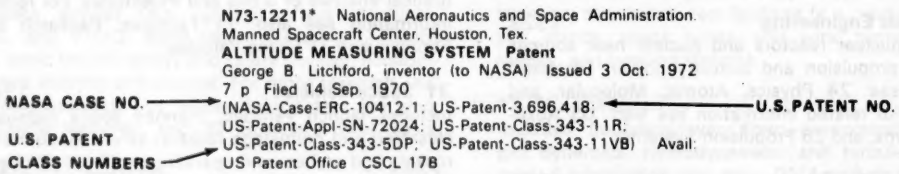


N73-10318*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
HYPERSONIC SHOCK-INTERACTION PHENOMENA APPLICABLE TO SPACE SHUTTLE CONFIGURATIONS
John J. Bertin and Bruce W. Graumann Aug. 1972 97 p refs
(Contract NAS9-11082)
(NASA-CR-128586; ER-72003) Avail: NTIS HC $7.00 CSCL 20D

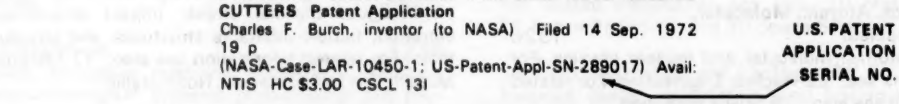
The convective heat transfer distribution for space shuttle configurations is discussed. The viscous/inviscid interactions associated with the complex three dimensional flow fields are examined. Two basic conditions are considered as follows: (1) models consisting of basic elemental combinations and (2) models of specific flight vehicles. The test facilities and test programs used to obtain data on the fuselage flow field and the wing flow field are described. Author

PATENT CITATION



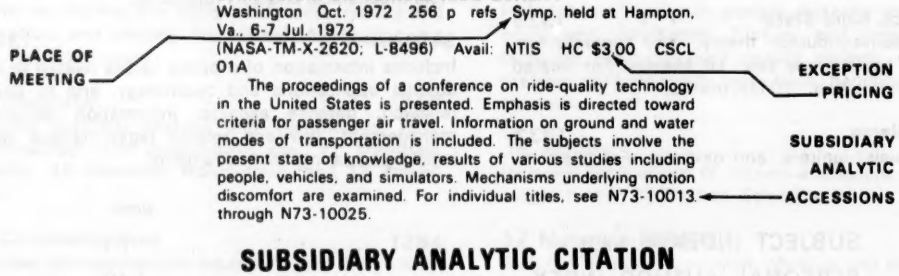
N73-12211* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ALTITUDE MEASURING SYSTEM Patent
George B. Litchford, inventor (to NASA) Issued 3 Oct. 1972 7 p Filed 14 Sep. 1970
(NASA-Case-ERC-10412-1; US-Patent-3,696,418; US-Patent-Appl-SN-72024; US-Patent-Class-343-11R; US-Patent-Class-343-5DP; US-Patent-Class-343-11VB) Avail: US Patent Office CSCL 17B

PATENT APPLICATION CITATION



N73-10504*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GRINDING ARRANGEMENT FOR BALL NOSE MILLING CUTTERS Patent Application
Charles F. Burch, inventor (to NASA) Filed 14 Sep. 1972 19 p
(NASA-Case-LAR-10450-1; US-Patent-Appl-SN-289017) Avail: NTIS HC $3.00 CSCL 13I

PRIMARY ANALYTIC CITATION AND ABSTRACT



N73-10012*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SYMPOSIUM ON VEHICLE RIDE QUALITY
Washington Oct. 1972 256 p refs Symp. held at Hampton, Va., 6-7 Jul. 1972
(NASA-TM-X-2620; L-8496) Avail: NTIS HC $3.00 CSCL 01A

The proceedings of a conference on ride-quality technology in the United States is presented. Emphasis is directed toward criteria for passenger air travel. Information on ground and water modes of transportation is included. The subjects involve the present state of knowledge, results of various studies including people, vehicles, and simulators. Mechanisms underlying motion discomfort are examined. For individual titles, see N73-10013 through N73-10025.

SUBSIDIARY ANALYTIC CITATION

N73-10014* Douglas Aircraft Co., Inc., Long Beach, Calif.
AN AIRCRAFT MANUFACTURER'S APPROACH TO RIDEABILITY CRITERIA
R. C. OMassey, H. Leve, and J. G. Gaume *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 23-49 refs (For availability see N73-10012 01-02)
CSCL 01A

VOLUME 11 NUMBER 11 / JUNE 8, 1973

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N73-19992* + National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 25 DECEMBER 1972
Dec. 1972 70 p refs
(NASA-SP-7037(25)) Avail: NTIS HC $3.00 CSCL 01B

This special bibliography lists 373 reports, articles, and other documents introduced into the NASA scientific and technical information system in November 1972. Author

N73-19993* + National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 26 JANUARY 1973
Jan. 1973 126 p refs
(NASA-SP-7037(26)) Avail: NTIS HC $3.00 CSCL 01B

This special bibliography lists 448 reports, articles, and other documents introduced into the NASA scientific and technical information system in December 1972. Author

N73-19994# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Dept. of Dynamics and Computation.
SOME TEST CASES, BASED ON ANALYTICAL METHODS IN LINEARIZED SUPERSONIC OSCILLATING LIFTING SURFACE THEORY, PART 2
A. J. L. R. Hasekamp 11 Jan. 1972 279 p refs
(FOK-X-440) Avail: NTIS HC $16.00

Algol 60 procedures are described which calculate velocity potential and pressure distribution on 3 types of planforms oscillating harmonically in a supersonic mainstream linearized theory. The formulations underlying the procedures are based on analytical methods, so that results from each procedure are exact within linearized theory, apart from errors due to calculation with finite precision. Author

N73-19995*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OVERALL AND BLADE-ELEMENT PERFORMANCE OF A TRANSONIC COMPRESSOR STAGE WITH MULTIPLE-CIRCULAR-ARC BLADES AT TIP SPEED OF 419 METERS PER SECOND
George Kovich and Lonnie Reid Washington Mar. 1973 111 p refs
(NASA-TM-X-2731; E-6823) Avail: NTIS HC $3.00 CSCL 21E

A 50-centimeter-diameter axial-flow transonic compressor stage with multiple-circular-arc blades was designed and tested to study the effects of blade shape on efficiency and stall margin. At design speed, peak efficiency of 0.80 occurred at an equivalent weight flow of 29.0 kilograms per second. Measured total pressure ratio and total temperature ratio at peak efficiency were 1.69 and 1.20, respectively. The stall margin at design speed and an equivalent weight flow of 29.0 kilograms per second was 9 percent. The measured stall margin at design weight flow and speed was 15 percent. A comparison of rotor performance made with and without the stator showed a decrease in pressure ratio, peak efficiency, and maximum weight flow with the addition of the stator. Author

N73-19996*# Scripta Technica, Inc., Washington, D.C.
GAS FLOWS PAST BLUNT BODIES. PART 2: TABLES OF THE GASDYNAMIC FUNCTIONS
A. N. Lyubimov and V. V. Rusanov Feb. 1973 398 p refs
Transl. into ENGLISH of the book "Techeniya Gaza Okolo Tupykh Tel, chast 2: Tablitsy Termodinamicheskikh Funktsiy" Moscow, Nauka Press, 1970 p 1-379
(Contract NASw-2036)
(NASA-TT-F-715) Avail: NTIS HC $6.00 CSCL 20D

Tables of flows of an inviscid gas past blunt bodies are presented. Gasdynamic functions in three-dimensional, axisymmetric, and plane gas flows past paraboloids, hyperboloids, spheres, cylinders, and other bodies, for both subsonic and supersonic regions. Calculated results for axisymmetric flows with consideration of dissociation and ionization, to include gas compositions, are developed. Coordinates of the sonic lines and limiting characteristics in axisymmetric and plane flows are given. The tables were computed to cover a broad range of parameter variation. Author

N73-19997*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A LOW-PRESSURE-RATIO CENTRIFUGAL COMPRESSOR WITH FOUR DIFFUSER DESIGNS
Hugh A. Klassen Washington Mar. 1973 26 p refs
(NASA-TN-D-7237; E-7296) Avail: NTIS HC $3.00 CSCL 20D

A low-pressure-ratio centrifugal compressor was tested with four different diffuser configurations. One diffuser had airfoil vanes. Two were pipe diffusers. One pipe diffuser had 7.5 deg cone diffusing passages. The other had trumpet-shaped passages designed for linear static-pressure rise from throat to exit. The fourth configuration had flat vanes with elliptical leading edges similar to those of pipe diffusers. The side walls were contoured to produce a linear pressure rise. Peak compressor efficiencies were 0.82 with the airfoil vane and conical pipe diffusers, 0.80 with the trumpet, and 0.74 with the flat-vane design. Surge margin and useful range were greater for the airfoil-vane diffuser than for the other three. Author

N73-19998*# Boeing Commercial Airplane Co., Seattle, Wash.
DESIGN INTEGRATION AND NOISE STUDIES FOR JET STOL AIRCRAFT. TASK 7B: WIND TUNNEL INVESTIGATION OF A 14-PERCENT-THICK AIRFOIL WITH UPPER SURFACE BLOWING AT HIGH SUBSONIC MACH NUMBERS Final Research Report, Jun. 1972 - Jan. 1973
Avtar S. Mahal and I. J. Gilchrist Jan. 1973 44 p refs

(Contract NAS2-6344)
(NASA-CR-114560; D6-60182) Avail: NTIS HC $4.25 CSCL 01A

An exploratory wind tunnel test has been conducted at Mach numbers from 0.60 to 0.80 to investigate the effects of nozzle geometry and upper surface blowing on the aerodynamic characteristics of a 14-percent-thick airfoil. Measured data included lift, drag, pitching moments, surface pressures, and nozzle thrust. Author

N73-19999*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STEADY, SUBSONIC, LIFTING SURFACE THEORY FOR WINGS WITH SWEPT, PARTIAL SPAN, TRAILING EDGE CONTROL SURFACES
Richard T. Medan Washington Apr. 1973 35 p refs
(NASA-TN-D-7251; A-4521) Avail: NTIS HC $3.00 CSCL 01A

A method for computing the lifting pressure distribution on a wing with partial span, swept control surfaces is presented. This method is valid within the framework of linearized, steady, potential flow theory and consists of using conventional lifting surface theory in conjuction with a flap pressure mode. The cause of a numerical instability that can occur during the quadrature of the flap pressure mode is discussed, and an efficient technique to eliminate the instability is derived. This technique is valid for both the flap pressure mode and regular pressure modes and could be used to improve existing lifting surface methods. Examples of the use of the flap pressure mode and comparisons among this method, other theoretical methods, and experiments are given. Discrepancies with experiment are indicated and candidate causes are presented. It is concluded that the method can lead to an efficient and accurate solution of the mathematical problem when a partial span, trailing edge flap is involved. Author

N73-20000*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SUBSONIC AERODYNAMIC CHARACTERISTICS OF A SHUTTLE-ORBITER CONFIGURATION DESIGNED FOR REDUCED LENGTH
George M. Ware and Bernard Spencer, Jr. Washington Apr. 1973 40 p refs
(NASA-TM-X-2712; I-8712) Avail: NTIS HC $3.00 CSCL 01A

An investigation has been made in a low-turbulence pressure tunnel to determine the low-subsonic aerodynamic characteristics of a 0.01875-scale model of a potential shuttle orbiter. The design has the rocket engines mounted in fairings on either side of the body on top of the wing. The wing had a leading-edge sweep of 50 and a trailing-edge sweep of minus 4. Configurations investigated included engine-mounted twin dorsal tails at various rollout angles, a body-mounted center-line vertical tail, cylindrical and boattailed afterbody, and elevon and rudder at several deflections. Author

N73-20001# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
DESIGN AND INITIAL OPERATION OF A 3-DEGREE OF FREEDOM MAGNUS ROTOR IN A MAGNETIC BALANCE SYSTEM
James B. Coffin and Charles W. Haldeman Jan. 1973 25 p refs
(Contract DAAA21-72-C-0254)
(AD-755108; PA-TM-2069) Avail: NTIS CSCL 14/2

Progress is reported on an experimental program to determine the Magnus forces on the center of gravity and the rotational startup response of a self-spinning rotor in a subsonic air stream. Development of a new type of model for the magnetic balance system was required in order to provide rotational freedom about all three axes. The design, construction and initial testing of this model at low subsonic speeds are discussed. The results indicate that models with three degrees of rotational freedom can be suspended with the magnetic balance system and tested in a subsonic air stream. Because of the force limits of the present balance system, the maximum operating dynamic pressure for this model is low. Author (GRA)

N73-20002# Naval Ordnance Lab., White Oak, Md.
THE EFFECT OF BASE BLEED ON THE DRAG AND MAGNUS CHARACTERISTICS OF A ROTATING BODY OF REVOLUTION
Frank J. Regan and Virginia L. Schermerhorn 22 Aug. 1972 99 p refs
(AD-754755; NOLTR-72-204) Avail: NTIS CSCL 20/4

Base bleed is a technique whereby all or part of the boundary layer is bled from the rear portion of a projectile to the base region. Passage from the model's surface to the base region is by means of concentric cylindrical passageways. The purpose of base bleed is to reduce the Magnus moment on overlong spinning bodies of revolution and to reduce the base drag. Both analytic and experimental results are presented. The boundary layer is represented by means of the momentum thickness. GRA

N73-20003# Hydronautics, Inc., Laurel, Md.
ON THE AERODYNAMICS OF WAKE VORTICES
Clinton E. Brown Oct. 1972 36 p refs Revised
(AD-754055; TR-7115; AFOSR-72-1209TR) Avail: NTIS CSCL 01/2

The effect of wing span loading on the development of fully rolled up wing trailing vortices is discussed. It is shown that parabolic wing loadings produce potential flow maximum core rotary speeds which are finite and less than fifty percent of the downwash speeds at the plane of symmetry. The development of turbulent cores is analyzed and core growth is predicted to occur as the two thirds power of time whereas the peak velocities fall off as the inverse one third power. Axial flow effects of the wing profile drag and lifting system are shown to lead to axial jets on the vortex axis which may either follow the aircraft or exceed the free stream velocity depending on the ratio of profile drag to induced drag. Author (GRA)

N73-20004# Douglas Aircraft Co., Inc., Long Beach, Calif.
A GENERAL METHOD FOR CALCULATING THREE-DIMENSIONAL INCOMPRESSIBLE LAMINAR AND TURBULENT BOUNDARY LAYERS. 1: SWEPT INFINITE CYLINDERS AND SMALL CROSS FLOW
Tuncer Cebeci, G. J. Mosinskis, and Kalle Kaups Nov. 1972 69 p refs
(Contract N00014-72-C-0111)
(AD-754440; MDC-J5694) Avail: NTIS CSCL 01/3

The report presents a general method for solving the laminar and turbulent boundary layer equations for swept infinite cylinders and for small cross flows. In the equations the Reynolds shear stress terms are eliminated by using an eddy viscosity concept. An efficient two-point finite-difference method is used to solve the governing equations. The method has been programmed on the IBM 0/165. Author (GRA)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N73-20005 National Lending Library for Science and Technology, Boston Spa (England).
AIR EFFECTS IN AIRCRAFT HYDRAULIC SYSTEMS: MEASURES FOR THEIR REMOVAL
E. Koch 4 Dec. 1972 18 p refs Transl. into ENGLISH from Oelhydraulik und Pneumatic, v. 15, no. 11, 1971 p 465-469 In ENGLISH and GERMAN
(NLL-NEL-TT-2420-(6075.461)) Avail: Natl. Lending Library, Boston Spa, Eng.: 2 NLL photocopy coupons

The effects of air in the pressure medium of hydraulic systems on the compressibility of the oil-air mixture are discussed. The nature of the occurrence of air in oils is described. Typical hydraulic systems are examined to show susceptibility to air contamination.

Methods for removing air from hydraulic systems are reported. Author

N73-20006*# General Electric Co., Schenectady, N.Y. Research and Development Center.
SUBSONIC AND SUPERSONIC JETS AND SUPERSONIC SUPPRESSOR CHARACTERISTICS
H. T. Nagamatsu and R. E. Sheer, Jr. 10 Nov. 1972 121 p refs
(Contract NASw-1784)
(NASA-CR-131297) Avail: NTIS HC $8.25 CSCL 01C

Convergent and parallel flow nozzles were used with room temperature air to investigate the flow and acoustic characteristics over a Mach number range of 0.6 to 1.5. For subsonic jets the maximum sound pressure levels occurred at 19.1 from the axis and the sound pressure level decreased monotonically with increasing angle. But for supersonic jets the sound pressure was nearly constant over most of angular positions. The power spectra for subsonic jets were similar with the peak occurring at 4 KHz and for a Mach 1.4 jet the peak occurred at 5 KHz. Near field sound pressure level distributions were quite similar for subsonic jets, but for supersonic jets the distributions were quite different. Mean and fluctuating velocity contours were determined for a convergent nozzle with the impact and piezoelectric impact pressure gage probes for Mach numbers of 0.6 to 1.4. A supersonic suppressor of 191 tubes and shrouds was investigated at Mach numbers of 1.4 and 0.7. Author

N73-20007# Cranfield Inst. of Technology (England). Coll. of Aeronautics.
AEROPLANE DESIGN STUDY STOL AIRLINER (A7-1). PART 1: CONFIGURATION DESCRIPTION AND DATA
D. Howe and R. E. Ward Jun. 1972 32 p refs
(CRANFIELD-AERO-12-Pt-1) Avail: NTIS HC $3.75

The aerodynamic configuration and design parameters of a short takeoff and landing airliner are discussed. The aircraft was designed to operate from 2,000 foot long single runways. Normal cruising speed is Mach 0.83 at 30,000 feet altitude. The estimated gross weight is 115,000 pounds. Approach speed is 79 knots at a landing weight of 100,000 pounds. The high lift coefficients are obtained either by externally blown jet flaps or an augmenter wing arrangement. Author

N73-20008*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WING UPPER SURFACE FLAP Patent Application
Howard W. Stone, Jr., inventor (to NASA) Filed 14 Dec. 1972 10 p
(NASA-Case-LAR-11140-1; US-Patent-Appl-SN-315068) Avail: NTIS HC $3.00 CSCL 01C

A system for providing yaw control in vehicles flying at high angles of attack and high supersonic and hypersonic speeds is described. The system consists of flaps mounted on the leading edges of a swept wing which can be deflected to provide a yawing moment to compensate for loss of yaw control normally provided by the rudder. A diagram of the installation is provided and the aerodynamic characteristics of the system are explained. Author

N73-20009# National Aviation Facilities Experimental Center, Atlantic City, N.J.
DESIGN CALCULATIONS FOR A HALON 1301 DISTRIBUTION TUBE FOR AN AIRCRAFT CABIN FIRE EXTINGUISHING SYSTEM Final Report, Jun. - Aug. 1972
Jack A. Jones and Constantine P. Sarkos Apr. 1973 30 p refs
(Proj. 184-732-03X)
(FAA-NA-73-3; FAA-RD-73-32) Avail: NTIS HC $3.50

Theoretical calculations were performed to aid in the design of a perforated tube that will uniformly distribute Halon 1301 throughout the unventilated passenger cabin of a commercial air transport. Conditions for the calculations were those of a passenger cabin of a DC-7 fuselage, with a volume of 4000 cubic feet and a length of 72 feet, being used as a test article for evaluating the performance of such a system. Four separate calculations were made to determine the: (1) size and number of orifices in the tube required for various Halon 1301 discharge rates; (2) pressure drop as a function of tube diameter and discharge rates; (3) time required to fill the tube with Halon 1301 for various tube diameters; and (4) cabin temperature and pressure after completion of Halon 1301 discharge. Author

N73-20010*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A NONLINEAR THEORY FOR SONIC-BOOM CALCULATIONS IN A STRATIFIED ATMOSPHERE
Michael Schorling Washington Mar. 1973 36 p refs
(NASA-TN-D-7105; L-8094) Avail: NTIS HC $3.00 CSCL 20A

The exact solutions to the equations of gas dynamics are given with respect to the axis of slender lifting bodies in a stratified atmosphere. The boundary condition is satisfied by using slender-body theory. The solution predicts the magnitude of the pressure rise of the sonic boom and estimates the nonlinear effects in the vicinity of the cutoff point. Author

N73-20011*# Martin Marietta Corp., Denver, Colo.
BALLOON LAUNCHED DECELERATOR TEST PROGRAM: POST-FLIGHT TEST REPORT, BLDT VEHICLE AV-2, VIKING 1975 PROJECT
D. Dickinson, F. Hicks, J. Schlemmer, F. Michel, and R. D. Moog 15 Dec. 1972 203 p refs
(Contract NAS1-9000)
(NASA-CR-112177; TR-3720291) Avail: NTIS HC $12.25 CSCL 01B

The pertinent events concerned with the launch, float, and flight of balloon launched decelerator test vehicle AV-2 are discussed. The performance of the decelerator system is analyzed. Data on the flight trajectory and decelerator test points at the time of decelerator deployment are provided. A description of the time history of vehicle events and anomalies encounters during the mission is included. Author

N73-20012*# Martin Marietta Corp., Denver, Colo.
BALLOON LAUNCHED DECELERATOR TEST PROGRAM: POST-FLIGHT TEST REPORT, BLDT VEHICLE AV-3, VIKING 1975 PROJECT
D. Dickinson, F. Hicks, J. Schlemmer, F. Michel, and R. D. Moog Jan. 1973 169 p refs
(Contract NAS1-9000)
(NASA-CR-112178; TR-3720293) Avail: NTIS HC $10.50 CSCL 01B

The pertinent events concerned with the launch, float, and flight of balloon launched decelerator test vehicle AV-3 are discussed. The performance of the decelerator system is analyzed. Data on the flight trajectory and decelerator test points at the time of decelerator deployment are provided. A description of the time history of vehicle events and anaomalies encounters during the mission is included. Author

N73-20013*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYTICAL STUDY OF THE PERFORMANCE OF A GUST ALLEVIATION SYSTEM FOR A STOL AIRPLANE
Waldo I. Oehman Washington Apr. 1973 40 p refs
(NASA-TN-D-7201; L-8654) Avail: NTIS HC $3.00 CSCL 01C

An analytical study has shown that a gust alleviation system for a STOL airplane in a cruise condition could reduce the root mean square of the normal acceleration of the airplane flying in random turbulence by as much as 50 percent. This alleviation is obtained by driving the flaps in response to normal acceleration and by moving the elevator in proportion to the commanded flap deflection angle and to a pitch-rate signal. Author

N73-20014*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LOW SPEED WIND TUNNEL INVESTIGATION OF A LARGE SCALE LIFT FAN STOL TRANSPORT MODEL
Adolph Atencio, Jr., Leo P. Hall, and Jerry V. Kirk Feb. 1973 123 p refs Prepared in cooperation with Army Air Mobility Res. and Develop. Lab., Moffett Field, Calif.
(NASA-TM-X-62231) Avail: NTIS HC $8.50 CSCL 01B

The low-speed aerodynamic characteristics of large scale V/STOL transport models with lift fan and lift-cruise fan propulsion systems are discussed. The model of this investigation had two

fans mounted side by side in the nose section of the fuselage. This permitted a reasonably deep inlet on the inboard side of each fan while the outboard side had a fairly shallow inlet. Lift-cruise fans were installed on the aft section of the fuselage. Hood-type deflection ducts were used to turn the fan flow from the cruise direction to the lift direction for STOL performance. Fan performance is shown for all four fans both statically and with crossflow. Longitudinal force and moment results are shown for a representative tip speed (forward speed) range through wing supported flight. Lateral-directional characteristics are also presented. The results are presented without analysis. Author

N73-20015# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORTS, BRIEF FORMAT: US CIVIL AVIATION. ISSUE NO. 5: 1971 ACCIDENTS
9 Jan. 1973 529 p
(NTSB-BA-73-1) Avail: NTIS HC $28.50

This publication contains selected aircraft accident reports, in brief format, occurring in U. S. Civil Aviation operations during calendar year 1971. The 953 General Aviation accidents contained in this publication represent a random selection. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, kind of flying injury index, aircraft damage, conditions of light, pilot certificate, injuries, and causal factors. Author

N73-20016*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ECONOMICS AND TERMINAL AREA ENVIRONMENTAL IMPACT OF STOL TRANSPORTATION
Elwood C. Stewart Feb. 1973 15 p
(NASA-TM-X-62239) Avail: NTIS HC $3.00 CSCL 01C

The impact of short takeoff and landing aircraft in meeting the needs of short haul transportation systems is analyzed. The objectives of the short haul system are evaluated on the basis of the following criteria: (1) service to the passenger, (2) economic viability, and (3) terminal area environment conditions caused by community noise, ground and air decongestion, and air pollution. Data are presented in the forms of tables, charts, and graphs. An itemization of the conclusions reached after the preliminary investigation is included. Author

N73-20017*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
A PRELIMINARY EVALUATION OF NOISE REDUCTION POTENTIAL FOR THE UPPER SURFACE BLOWN FLAP
R. E. Hayden, T. D. Scharton, Y. Kadman, J. Wilby, and M. J. Rudd [1972] 44 p
(Contract NAS1-11839)
(NASA-CR-112246; BBN-2478) Avail: NTIS HC $4.25 CSCL 01C

An assessment of the basic acoustic characteristics and noise reduction potential of an upper surface blown flap consisting of a rectangular nozzle and a single turning flap which was designed to approximate a typical takeoff setting is presented. The noise reduction concepts studied were: (1) replacing a section of the flap trailing edge with a porous material and (2) active modification of the flow field using blowing near the trailing edge. Diagrams of the airfoil section and test equipment are provided. Photographs of airflow conditions across the aerodynamic surface are included. Author

N73-20018*# Lockheed-California Co., Burbank.
FLIGHT SERVICE EVALUATION OF PRD-49/EPOXY COMPOSITE PANELS IN WIDE BODIED COMMERCIAL TRANSPORT AIRCRAFT Final Report
John H. Wooley, Dale R. Paschal, and Eugene R. Crilly Mar. 1973 72 p refs
(Contract NAS1-11621)
(NASA-CR-112250) Avail: NTIS HC $5.75 CSCL 01C

L-1011 aircraft fairing panel configurations were selected as test parts to compare the fabrication, costs and service performance characteristics of PRD-49 and fiberglass. These parts are currently fiberglass reinforced structure and the purpose of this program is to evaluate the results of direct substitution of PRD-49 fabric for the fiberglass. Three ship sets of these panels have been fabricated for a five year flight service evaluation on three L-1011 commercial airliners operating in widely diverse route structures. The standard tools and machining techniques used for fiberglass parts are unacceptable for cutting, trimming, and drilling the tougher PRD-49 fibers. Therefore, a machining development study was undertaken to provide the necessary new tools and machining techniques. After incorporating these new developments in the fabrication and installation of the panels, a manufacturing cost study revealed that the labor hours were only increased by about 12.5 percent. Author

N73-20019*# Kanner (Leo) Associates, Redwood City, Calif.
EFFICIENCY STUDIES ON COCKPIT DISPLAYS
R. Beyer Washington NASA Apr. 1973 33 p refs Transl. into ENGLISH from the 5th Yearly Meeting of the DGLR (Berlin), 4-6 Oct. 1972 30 p
(Contract NASw-2481)
(NASA-TT-F-14846) Avail: NTIS HC $3.75 CSCL 01C

A comparative evaluation of two forms of cockpit displays should take into account the control accuracy obtainable and the workload to which the pilot is subjected in following the indications of the displays in both cases. Factors to be considered for an assessment of cockpit displays include data for aircraft control, experimental psychological data, physiological measurements and subjective evaluations. The examples discussed show the complexity of the evaluation process for a given cockpit display. Author

N73-20020*# Linguistic Systems, Inc., Cambridge, Mass.
DESCRIPTION AND IMPLEMENTATION OF A METHOD FOR CHARACTERIZING NOISE SOURCES IN JETS
J. Taillet Washington NASA Apr. 1973 27 p refs Transl. into ENGLISH from "Description et Mise en Oeuvre d'une Methode de Caracterisation des Sources de Bruit dans let Jets" Chantillon-sous-Bagneux, France, ONERA report Presented at the 8th Congr. of the Intern. Council of the Aeron. Sci., Amsterdam, 28 Aug. - 2 Sep. 1972
(Contract NASw-2482)
(NASA-TT-F-14851) Avail: NTIS HC $3.50 CSCL 01C

A technique for characterizing noise sources in jets which is based on the measurement of infrared emission is described. The proposed method is an extension of Lighthill's theory and takes as the initial variables the mean parameters and the moments derived from experimentally obtained fluctuating parameters, which are introduced into a computer program yielding the spectrum and the radiation pattern of the sonic far field. The acoustic variables can thus be calculated from the measured characteristics of the jet turbulence, so that the problem of noise reduction is reduced to an aerodynamics problem. Author

N73-20021# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
THERMAL PACKAGE ANALYSIS OF THE SCHONFELDER PACKAGES (MAX PLANCK INSTITUTE MUNICH)
Leland A. Carlson and A. E. Cronk [1973] 25 p
(Contract NCAR-1-73)
(TAMRF-921-7305) Avail: NTIS HC $3.25

A thermal analysis of a typical pressurized high-altitude balloon package was conducted. The temperature time histories of various package components and the effects of ascent, sunrise, surface coating, insulation-type, internal power, and descent are presented. Author

N73-20022*# New York Univ., N.Y.
STUDIES OF ENGINE-AIRFRAME INTEGRATED HYPERSONIC VEHICLES
Heywood Saland, Herbert Fox, and Walter Hoydysh [1972] 32 p refs
(Grant NGR-33-016-131)
(NASA-CR-112300) Avail: NTIS HC $3.75 CSCL 01C

A parametric study of an integrated airframe and engine is presented for a hypersonic transport at an altitude of 70,000 feet and a free stream Mach number of 6. The engine considered is a subsonic combustion ramjet using conventional hydrocarbon fuels. The lift-to-drag ratio of the aircraft for two configurations, one with full capture and accelerated flight and the other allowing spillage of the leading shock and in unaccelerated flight, is studied. The parameters varied are the engine

efficiencies, the angle of attack, the combustion rates, as well as the captured mass flow. Lift-to-drag ratios on the order of 6.5 are obtained. Author

N73-20023# Advisory Group for Aerospace Research and Development, Paris (France).
A SUMMARY OF THE ANALYSIS OF GUST LOADS RECORDED BY COUNTING ACCELEROMETERS ON SEVENTEEN TYPES OF AIRCRAFT
I. W. Kaynes (RAE, Farnborough) Dec. 1972 713 p refs Presented at the 35th Struct. and Mater. Panel Meeting, Toulouse, France, 25 Sep. 1972
(AGARD-R-605; AGARD-586-Add) Avail: NTIS HC $7.75

The collection and processing of gust load data obtained from counting accelerometers during twenty years of recording is described. Tables of the accelerations and equivalent gusts are presented, the latter having been calculated by both discrete and spectral gust models. The gust frequency distributions are discussed. Author

N73-20024# Army Electronics Command, Fort Monmouth, N.J.
AN ANALOG COMPUTER SIMULATION OF A GENERALIZED HELICOPTER ROTOR SYSTEM
Tunis Robbins Nov. 1972 57 p refs
(DA Proj. 1H1-62202-A-219)
(AD-754547; ECOM-4043) Avail: NTIS CSCL 01/3

The report describes an analog simulation of a generalized single-rotored helicopter rotor system as programmed on an EAI 231R-V analog computer. The simulation described is modeled from equations of motion of sufficient detail so as to permit the use of the simulation in flight control and avionics design studies. The program is suitable for use in a hybrid computer total forces and moments simulation or as a part of a more simplified analog computer model of a single rotored helicopter. An automatic setup and check program is described which allows rapid reconfiguration of the analog rotor program to represent many different kinds of rotor systems, including the hingeless and articulated types with any number of blades. Author (GRA)

N73-20025# Naval Postgraduate School, Monterey, Calif.
GENERALIZED PERFORMANCE LIMITS FOR PROPELLERS, WINDMILLS AND LIFTING ROTORS WITH AXES PARALLEL TO THE UNDISTURBED FLOW
Theodore H. Gawain Dec. 1972 104 p ref
(AD-754072; NPS-57GN72121A) Avail: NTIS CSCL 01/3

The report generalizes the classical momentum theory as usually applied to propellers, windmills and lifting rotors into a single unified treatment. It also extends the analysis to include the regime in which flow through part or all of the actuator disc is reversed with respect to the remote flow field. Dimensional analysis is used in a systematic manner to reduce the final results to their simplest and most significant forms. It is shown that the performance of these devices can always be represented by a single parameter family of curves in which the parameter expresses the extent to which the performance of the actual device falls short of the theoretical limit. Detailed algebraic solutions are derived in closed form for the performance of both the idealized zero torque and finite torque actuators; these represent performance limits which any comparable real device may approach but never exceed. A qualitative analysis is presented concerning the development of the vortex ring state. The fundamental dynamic stability of the ideal lifting rotor is also analyzed. While this paper deals with a classical topic in fundamental fluid mechanics, the approach employed is original and many of the results derived here are in a form that is essentially new. Author (GRA)

N73-20026# National Bureau of Standards, Washington, D.C.
AIR DENSITY AND HELICOPTER LIFT Final Report
Frank E. Jones Jan. 1973 58 p refs
(Contract NAonr-15-72; NR Proj. 213-096)
(AD-754420; NBS-10882; JANAIR-721201) Avail: NTIS CSCL 20/4

An analysis has been made of ideal and real gas equations as they apply to the calculation of air density in the region of interest for helicopter flight. The uncertainties in calculated air density due to uncertainties in measurements of temperature, pressure and humidity have been investigated and estimates have been made of measurement accuracies which would be required to enable calculation of air density with a desired relative uncertainty. A reference system has been assembled to provide measurements of temperature, pressure and dew-point temperature aboard a helicopter. This system is to be used in making calculations of reference air density for flight tests of a system for computing hover lift margin and several devices for measuring air density. GRA

N73-20027# System Development Corp., Santa Monica, Calif.
ANNOTATED BIBLIOGRAPHY ON CUMULATIVE FATIGUE DAMAGE AND STRUCTURAL RELIABILITY MODELS
V. K. Murthy and G. B. Wartz Dec. 1972 262 p refs
(Contract F33615-71-C-1776; AF Proj. 7071)
(AD-754062; SDC-SP-3663; ARL-72-0161) Avail: NTIS CSCL 01/3

The authors selected almost one hundred publications in the area of modeling cumulative fatigue damage of airframe and helicopter rotor blade structures bringing to light the salient contributions as well as the limitations and assumptions in each of these papers. GRA

N73-20028*# Michigan Univ., Ann Arbor.
PROCEEDINGS OF THE 8TH ANNUAL CONFERENCE ON MANUAL CONTROL
Richard W. Pew Wright-Patterson AFB, Ohio AFFDL Jul. 1972 649 p refs Conf. held at Ann Arbor, Mich., 17-19 May 1972
(Contract NSR-23-005-364)
(NASA-CR-131244; AD-754908; AFFDL-TR-72-92) Avail: NTIS HC $34.50 CSCL 01/3

The volume presents recent developments in the field of manual control theory and applications. The papers give analytical methods as well as examples of the important interplay between man and machine, such as how man controls and stabilizes machine dynamics, and how machines extend man's capability. Included in the broad range of subjects are procedures to evaluate and identify display systems, controllers, manipulators, human operators, aircraft, and non-flying vehicles. Of particular interest is the continuing trend of applying control theory to problems in medicine and psychology, as well as to problems in vehicle control. Author (GRA)

N73-20029# Calspan Corp., Buffalo, N.Y.
FLIGHT INVESTIGATION OF VARIOUS LONGITUDINAL SHORT-TERM DYNAMICS FOR STOL LANDING APPROACH USING THE X-22A VARIABLE STABILITY AIRCRAFT Final Report, Aug. 1971 - Mar. 1972
R. E. Smith, J. V. Lebacqz, and J. M. Schuler Jan. 1973 218 p refs
(Contract N00019-71-C-0044)
(AD-754840; CAL-TB-3100-F-2) Avail: NTIS CSCL 01/3

The first in-flight flying qualities experiment using the variable stability X-22A aircraft investigated longitudinal flying qualities requirements for STOL aircraft in terminal area operations. Emphasis was placed on defining minimum requirements for the short-term response in VFR and IFR landing approaches at representative steep STOL approach conditions of 65 and 80 knots. Evaluation flights were conducted in negligible and moderate turbulence for a wide range of short-term frequencies and dampings. Identification of the dynamics of the evaluation configurations was performed, to a large extent, by a new, advanced digital identification technique developed for the X-22A aircraft. Author (GRA)

N73-20030# Mississippi State Univ., State College. Dept. of Aerophysics and Aerospace Engineering.
MEASUREMENTS OF VELOCITY COMPONENTS IN THE WAKE OF A FULL SCALE HELICOPTER ROTOR IN HOVER Final Report, Sep. 1970 - Sep. 1971
Donald W. Boatwright Aug. 1972 129 p refs
(Contract DAAJ02-67-C-0105; DA Proj. 1F1-62204-A-139)
(AD-754644; AASE-72-59; USAAMRDL-TR-72-33) Avail: NTIS CSCL 01/3

The report presents three-component wake velocity measurements made with a split-film total vector anemometer. The measurements were made in the wake of a full-scale OH-13E helicopter rotor which was mounted on a 60-foot rotor test

tower at Mississippi State University. Time-averaged velocity distributions along wake radii at various distances below the rotor disk were measured for two conditions of disk loading and three combinations of blade pitch and rotor speed. Instantaneous velocity measurements were made across the helical vortex trails to investigate the effects of blade pitch and rotor speed on vortex structure, core size, transport velocity, and distribution of axial and tangential velocity components within the vortices. Author (GRA)

N73-20031# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE OPERATION OF A TWO-CHAMBER PNEUDRAULIC SHOCK ABSORBER

N. A. Melik-Zade 4 Jan. 1973 19 p refs Transl. into ENGLISH from Mashinoved (Moscow), no. 2, 1971 p 44-50

(AF Proj. 1369)

(AD-754609; FTD-MT-24-964-72) Avail: NTIS CSCL 01/3

For the most common types of two chamber, pneumohydraulic shock absorbers for S type landing gear, the author presents the functions permitting the shock absorber's initial charging, motion, and force parameters, which arise during the static and dynamic compression of the landing gear by different methods, to be defined. The shock absorber's operational equations allow the author to create a generalized program for computer solution of the system of dynamic equations of the motion of a landing gear with different types of one chamber and two chamber shock absorbers. GRA

N73-20032# Honeywell, Inc., Minneapolis, Minn. Government and Aeronautical Products Div.

ADVANCED HYDROFLUIDIC STABILIZATION SYSTEM Final Technical Report, 23 Apr. 1971 - 23 Apr. 1972

Mark E. Ebsen and James O. Hedeen Ft. Eustis, Va. Army Air Mobility R and D Lab. Oct. 1972 150 p refs

(Contract DAAJ02-71-C-0040; DA Proj. 1F1-62204-AA-44)

(AD-754602; W0502-FR; USAAMRDL-TR-72-46) Avail: NTIS CSCL 01/3

The results of a design study to define and analyze a hydrofluidic flight control system for helicopters, incorporating pilot relief modes, are presented. The system defined provides the pilot with stability augmentation in three axes, over the total aircraft flight envelope, and with pitch and roll attitude hold, heading hold, and altitude hold over the normal range of cruise airspeeds. To obtain a relatively simple, low-cost system, control panel switching, electrical display gyros for attitude and heading signals, and series servoactuators for both stability augmentation and outer-loop modes are used. The study results indicate that a simple hydrofluidic flight control system which will provide significant relief for the pilot can be mechanized. Author (GRA)

N73-20033# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.

AIRCRAFT ACCIDENT REPORT: HUGHES AIR WEST DC-9, N9345, AND US MARINE CORPS F-4B, 151458 NEAR DURANTE, CALIFORNIA, 6 JUNE 1971

22 Sep. 1972 51 p

(PB-212987; NTSB-AAR-72-26) Avail: NTIS HC $3.00 CSCL 01B

A Hughes Air West DC-9, N9345, and a U.S. Marine Corps F-4B, 151458, collided in flight near Duarte, California, at approximately 1811 P.d.t., June 6, 1971. All 49 occupants aboard the DC-9 and the pilot of the F-4B were fatally injured. The National Transportation Safety Board determines that the probable cause of this accident was the failure of both crews to see and avoid each other but recognizes that they had only marginal capability to detect, assess, and avoid the collision. Author (GRA)

N73-20034# Notre Dame Univ., Ind. Dept. of Aerospace and Mechanical Engineering.

PARAFOIL POWERED FLIGHT PERFORMANCE Final Report

John D. Nicolaides Jan. 1972 116 p refs

(Contract F33615-71-C-1093; AF Proj. 6065)

(AD-754907; AFFDL-TR-72-23) Avail: NTIS CSCL 01/3

The predicted flight performance of a powered parafoil flight vehicle is calculated from solutions which are obtained from the parafoil equations of motion. Flight vehicle total weights of 350, 400, 500, and 540 pounds are considered. Parafoil wing areas of 200 square feet and 400 square feet are considered. Wing loadings include .875, 1.0, 1.25, 1.35, 1.75, 2.0, and 2.7 pounds per square foot. Steady state flight trim angles of attack cover a range from -6 degrees to -80 degrees. The flight performance analyses include level flight, climbing flight, and descending flight. The computed flight parameters include the total velocity, the rate of climb (sink), the angle of climb (descent), and the horsepower required for the type of flight under consideration. Author (GRA)

N73-20035# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

EVALUATION OF ENERGY MANEUVERABILITY PROCEDURES IN AIRCRAFT FLIGHT PATH OPTIMIZATION AND PERFORMANCE ESTIMATION Final Technical Report, Jul. 1967 - Aug. 1970

David T. Johnson Nov. 1972 87 p refs

(AD-754909; AFFDL-TR-72-58) Avail: NTIS CSCL 01/2

An assessment is made of the applicability of energy maneuverability techniques (EM) to flight path optimization. A series of minimum time and fuel maneuvers using the F-4C aircraft were established to progressively violate the assumptions inherent in the EM program and comparisons were made with the Air Force Flight Dynamics Laboratory's (AFFDL) Three-Degree-of-Freedom Trajectory Optimization Program and a point mass option of the Six-Degree-of-Freedom flight path program. It was found the EM results were always optimistic in the value of the payoff functions with the optimism increasing as the percentage of the maneuver involving constant energy transitions increases. For the minimum time paths the resulting optimism was less then 2% for the maneuvers where the constant energy percentage was less than 35% followed by a rather steeply rising curve approaching in the limit 100% error for paths which are comprised entirely of constant energy transitions. Author (GRA)

N73-20036# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DETERMINATION OF OPTIMUM PARAMETERS OF THE MEANS USED TO PROTECT THE COMPARTMENTS OF AN AIRCRAFT FROM AERODYNAMIC HEAT AT HIGH SPEEDS AND DURING A PROLONGED FLIGHT

F. G. Yasinskii 5 Jan. 1973 21 p refs Transl. into ENGLISH from Samoletostr. Tekh. Vozdush. Flota (USSR), no. 22, 1970 p 61-69

(AD-754606; FTD-HT-23-1755-72) Avail: NTIS CSCL 01/3

Optimum parameters of the means used to protect the aircraft compartments from aerodynamic heat are determined. The thermal conductivity coefficient is expressed in the form of a linear temperature function when studying the external and internal heat insulators. Coupling equations are used in computations using an electronic digital computer. Author (GRA)

N73-20037# Defense Documentation Center, Alexandria, Va.

SHORT TAKE-OFF PLANES Report Bibliography, Oct. 1960 - May 1972

Jan. 1973 219 p refs

(AD-754500; DDC-TAS-72-74) Avail: NTIS CSCL 01/3

The annotated bibliography contains unclassified and unlimited references on short take-off planes. Discussed are design, configurations, wing-body configurations, flight testing, wind tunnel tests, aerodynamic configurations, aerodynamic characteristics, handling qualities, performance and stability of short take-off planes. Corporate Author-Monitoring Agency, Subject, Title, and Personal Author Indexes are included. Author (GRA)

N73-20038# Ohio State Univ., Columbus.

PHYSICAL TECHNIQUES FOR CONTROLLING BIRDS TO REDUCE AIRCRAFT STRIKE HAZARDS: EFFECT OF LASER LIGHT ON BIRD BEHAVIOR AND PHYSIOLOGY Technical Report, Jun. 1971 - 30 Sep. 1972

Sheldon I. Lustick Dec. 1972 57 p refs

(Contract f29601-71-C-0122)

(AD-754269; AFWL-TR-72-159) Avail: NTIS CSCL 01/2

Three species of birds (starling, mallard duck, and herring gulls, were used to determine if high-intensity laser light could decrease the bird-strike hazard to aircraft. The effects of both

continuous and pulsing light of various wavelengths on bird behavior and physiology were determined. The responses of the birds were monitored both visually and electronically. The intensity of laser light striking the bird could be varied by changing the diameter of the laser beam. All species tested showed a group avoidance response. Discussed are the feasibility of using a laser system, the problems of using a laser system, and further research before implementing a laser system for controlling birds. Author (GRA)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N73-20039* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DELAYED SIMULTANEOUS RELEASE MECHANISM Patent
Xopher W. Moyer and John B. Webb, inventors (to NASA) Issued 6 Feb. 1973 7 p Filed 28 May 1970 Supersedes N70-34672 (8 - 18, p 3287)
(NASA-Case-GSC-10814-1; US-Patent-3,715,092; US-Patent-Appl-SN-41404; US-Patent-Class-244-1SS; US-Patent-Class-244-1SA) Avail: US Patent Office CSCL 13I

The disclosed appendage release mechanism is particularly adapted for use with spacecraft operating with despin mechanisms and releasable appendages. It includes a flexible loop and a number of appendage releasing devices which are attached to the flexible loop. The appendage releasing devices are made up of piston-cams and ball latches which hold the appendages as long as the flexible loop is maintained in a taut condition, but which release the appendages upon relaxation of the flexible loop. The flexible loop remains taut as long as the despin weights remain attached, but relaxes when the despin weights are released. Official Gazette of the U.S. Patent Office

N73-20040* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STACKED SOLAR CELL ARRAYS Patent
Jerome M. Weingart and Robert K. Yasui, inventors (to NASA) Issued 6 Feb. 1973 6 p Filed 22 Nov. 1971 Supersedes N72-20038 (10 - 11, p 1424) Sponsored by NASA
(NASA-Case-NPO-11771; US-Patent-3,715,600; US-Patent-Appl-SN-200762; US-Patent-Class-250-212; US-Patent-Class-250-234; US-Patent-Class-244-1.55; US-Patent-Class-60-26) Avail: US Patent Office CSCL 10A

A solar cell stack, for use in spacecraft, is described. In the stack only the top solar cell panel is exposed to solar energy to provide electrical power. Each panel except the top is covered from exposure to damaging bombarding particles by the preceding panels in the stack toward the top. When the exposed top panel's performance is degraded owing to bombardment by particles or other unexpected failure, the top panel is ejected, thereby exposing the underlying panel in the stack, which then becomes the power supplying panel. Thus each panel in the stack is successively exposed when the panel above it is ejected.
Official Gazette of the U.S. Patent Office

N73-20041*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THREE AXES CONTROLLER Patent Application
Charles L. Bailey, Jr., inventor (to NASA) Filed 15 Mar. 1973 22 p
(NASA-Case-MSC-12394-1; US-Patent-Appl-SN-341662) Avail: NTIS HC $3.25 CSCL 13I

Aircraft and spacecraft single-hand controllers are described which employ the principle of independent rotational movements about one or more axes. The controller can be manipulated to provide mutually independent controls of yaw, pitch, and roll axes. The hand grip is attached to a pitch control means and mounted about the pitch axis, which is perpendicular to the longitudinal axis through the controller. The pivotal mounting includes a resilient force mechanism which provides a stabilizing force to maintain the grip in neutral position. Rotation of the grip about the pitch axis produces direct rotation of a transducer element and an electrical indication of pitch. Diagrams are included. NASA

N73-20042*# McDonnell-Douglas Corp., St. Louis, Mo.
FLAME DETECTOR OPERABLE IN PRESENCE OF PROTON RADIATION Patent Application
John E. Turnage, Rodney Linford, and Steve Cornish, inventors (to NASA) Filed 21 Mar. 1973 34 p Sponsored by NASA
(NASA-Case-MFS-21577-1; US-Patent-Appl-SN-343308) Avail: NTIS HC $3.75 CSCL 01C

An ultraviolet radiation detector is described which operates in a vehicle orbiting through high-intensity radiation areas in space. It operates with two essentially identical ultraviolet sensor tubes within a shield which limits the amount of proton radiation reaching the sensor tubes to acceptable levels. The shield has an opening to permit ultraviolet radiation to reach one of the sensor tubes. This prevents ultraviolet radiation from reaching the other reference sensor tube. Both sensor tubes receive the same amount of proton radiation; but the sensing tube will also be able to receive ultraviolet radiation. The circuitry of the detector subtracts the output of the reference sensor tube from, that of the sensing tube; so any portion of the output of the sensing tube due to proton radiation is offset by the output of the reference tube. Thus the circuitry output of the detector is proportional to the amount of ultraviolet radiation reaching the sensing tube.
NASA

N73-20043*# Linguistic Systems, Inc., Cambridge, Mass.
THE EFFECT OF SELECTIVE COATINGS ON THE THERMAL BALANCE OF A SOLAR RADIATION RECEIVER
V. A. Baum and L. V. Bektenov Washington NASA Apr. 1973 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk Turkm. SSR, Ser. Fiz - Tekhn. Khim. i Geol. Nauk (Ashkhabad), no. 1, 1970 p 21-26
(Contract NASw-2482)
(NASA-TT-F-14850) Avail: NTIS HC $3.00 CSCL 10A

Coatings designed to improve the efficiency of devices in which water is heated by solar energy are studied. Factors governing the efficiency of boilers heated by solar radiation are examined. Increases in efficiency and an extension of the operational temperature range of the boilers obtainable by the application of coatings which change the absorption properties of the boiler surface are discussed. A polished copper surface with a coating of cobalt sesquioxide and a glass covering with tin oxide are found to be most effective. The efficiencies obtained for various surfaces and temperature conditions are listed.
Author

N73-20044*# Globe-Union, Inc., El Monte, Calif. Centralab Semiconductor Div.
DESIGN AND FABRICATION OF WRAPAROUND CONTACT SILICON SOLAR CELLS
G. Goodelle 5 Sep. 1972 32 p ref
(Contract NAS3-15345)
(NASA-CR-121003; Rept-6) Avail: NTIS HC $3.75 CSCL 10A

Work is reported on the development and production of 1,000 N+/P wraparound solar cells of two different design configurations: Design 1, a bar configuration wraparound and Design 2, a corner pad configuration wraparound. The project goal consisted of determining which of the two designs was better with regard to production cost where the typical cost of a conventional solar cell was considered as the norm. Emphasis was also placed on obtaining the highest possible output efficiency, although a minumum efficiency of 10.5% was required. Five hundred cells of Design 1 and 500 cells of Design 2 were fabricated. Design 1 which used similar procedures to those used in the fabrication of conventional cells, was the less expensive with a cost very close to that of a conventional cell. Design 2 was more expensive mainly because the more exotic process procedures used were less developed than those used for Design 1. However, Design 2 processing technology demonstrated a feasibility that should warrant future investigation toward improvement and refinement. Author

N73-20045*# Grumman Aerospace Corp., Bethpage, N.Y.
OAO BATTERY DATA ANALYSIS Final Report

S. Gaston, M. Wertheim, and J. ORourke Feb. 1973 471 p refs
(Contract NAS5-11465)
(NASA-CR-131414) Avail: NTIS HC $25.75 CSCL 10C

Summary, consolidation and analysis of specifications, manufacturing process and test controls, and performance results for OAO-2 and OAO-3 lot 20 Amp-Hr sealed nickel cadmium cells and batteries are reported. Correlation of improvements in control requirements with performance is a key feature. Updates for a cell/battery computer model to improve performance prediction capability are included. Applicability of regression analysis computer techniques to relate process controls to performance is checked. Author

N73-20046# Los Alamos Scientific Lab., N.Mex.
SPACE ELECTRIC POWER R AND D PROGRAM Quarterly Status Report, period ending 30 Apr. 1971
May 1972 11 p Sponsored by AEC
(LA-4690) Avail: NTIS

Resistivity tests on two sheathed insulator assemblies are being continued in the Omega West Reactor. The resistivity of the samples has leveled off at a value of about two orders of magnitude higher than the minimum required for thermionic reactor application. The tests have accumulated over 2000 h of irradiation time and are continuing. Three thermionic-converter test units are being disassembled and evaluated. Nine cermet fuel pins were produced for irradiation-testing in the Engineering Test Reactor. A cross-sectional sample taken from a pin that had been irradiated in the ETR calibration test was examined by various techniques and showed no tendency for interdiffusion between the phase containing uranium and yttrium and the metallic solid solution of molybdenum and tungsten. All molybdenum-tungsten regions were essentially homogeneous solid solutions which were distributed with reasonable uniformity throughout the cermet fuel. Author

N73-20047# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
THEORETICAL TREATMENT OF THE VERTICAL MULTI-JUNCTION SOLAR CELL Technical Report, 1 Jul. 1971 - 1 Mar. 1972
W. Patrick Rahilly Dec. 1972 43 p refs
(AF Proj. 3145)
(AD-754901; AFAPL-TR-72-77) Avail: NTIS CSCL 10/2

A brief theoretical treatment of the vertical multijunction solar cell is presented. The cell geometry considered was 2 cm x 2 cm x 250 microns. Solutions for the minority carrier diffusion equations were obtained so as to derive the light generated current per unit wavelength (spectral response) and total light generated current. The spectral response calculations revealed that enhanced carrier collection is predicted in the red portion of the sunlight spectrum. The total light generated current was found to increase asymptotically to a limit of nominally 190 milliamperes for increasing numbers of junctions.
Author (GRA)

N73-20048# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
FUEL CELLS Status Report No. 7
James R. Huff, ed. Oct. 1972 182 p refs
(AD-755106; USAMERDC-2039) Avail: NTIS CSCL 10/2

The report describes the present status of fuel cell research. Since any progress is a result of efforts over a wide range of research and development, it seemed appropriate to adopt a format which would reflect this breadth of effort. Therefore, the first four major sections cover the four categories of government funding; i.e., basic research, exploratory development, advanced development and engineering development. Research on power conditioning, which is a vital part of any fuel cell system is also discussed. Next the investigation of fuel cell reactions and mechanisms are reviewed. Finally, fuel cell research and development is going on in a number of foreign countries, and thus summaries of their work is given. GRA

N73-20049# AiResearch Mfg. Co., Phoenix, Ariz.
ADVANCED AUXILIARY POWER SYSTEM Final Technical Report, Nov. 1968 - May 1972
Andrew D. Meshew and Donald F. Swenski Wright-Patterson AFB, Ohio AFAPL 30 Nov. 1972 512 p
(Contract F33615-69-C-1100; AF Proj. 3145)
(AD-754903; SY-6055-R8-Rev-1; SC-6308; AFAPL-TR-72-59) Avail: NTIS CSCL 10/2

The purpose of the program was to advance the technology of small auxiliary power units, using the secondary power system requirements of a hypothetical fighter aircraft of mid-1970 as a goal and an auxiliary power system as a test bed for exploratory development. The APU was 10 in. in diameter by 24 in. long, and the design-point performance goal was 300 equivalent shaft horsepower at 2200F turbine inlet temperature and sea
Author (GRA)

N73-20050# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN QUESTIONS CONCERNING THE RELIABILITY OF MULTIPLE ELEMENT CHEMICAL CURRENT SOURCES
B. V. Belyaev and A. S. Iosifov 29 Dec. 1972 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Elektronekhan. (Novocherkassk), no. 5, 1971 p 574-577
(AD-754725; FTD-HT-23-1587-72) Avail: NTIS CSCL 10/3

Development of technology has created a need for highly reliable current sources such as batteries. One of the most promising are the silver-zinc cells (STsA) which yield high capacity per unit weight as compared to others. However, the present-day requirements for reliability and output electrical parameters force one to use the multiple element circuits for current sources. There are well-known works which propose methods for calculating the reliability of the multiple element current sources. These formulas are cumbersome and, often, are of little use for a more extensive analysis since they do not consider the power parameters of the circuit. Thus, a procedure is given for selecting and validating a computational formula for the reliability of multiple element circuits and is convenient for practical calculations.
Author (GRA)

N73-20051# Army Foreign Science and Technology Center, Charlottesville, Va.
MASS TRANSFER IN ELECTROCHEMICAL FUEL CELLS WITH ION EXCHANGE MEMBRANES
A. M. Ivanov 22 Jun. 1972 11 p refs Transl. into ENGLISH from Teplofiz. Vys. Temp. (Moscow), v. 8, no. 3, 1970 p 615-621
(AD-754258; FSTC-HT-23-824-72) Avail: NTIS CSCL 10/2

Basic questions characterizing the problem of optimum mass and heat transfer in electrochemical fuel cells are discussed. The effect of mass-transfer conditions on the output characteristics of fuel cells is examined, in hydrogen-oxygen fuel cells with ion exchange membranes. The inherent moisture content of ion exchange membranes and of the membrane-catalyst system are also described. GRA

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N73-20052*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 110, JANUARY 1973
Jan. 1973 95 p refs
(NASA-SP-7011(110)) Avail: NTIS HC $3.00 CSCL 06E

This special bibliography lists 314 reports, articles, and other documents introduced into the NASA scientific and technical information system in January 1973. Author

N73-20053*# Stanford Univ., Palo Alto, Calif. Cardiology Div.
BIOMEDICAL TECHNOLOGY TRANSFER APPLICATIONS OF NASA SCIENCE AND TECHNOLOGY Final Report, 1 Jul. 1971 - 30 Sep. 1972
30 Sep. 1972 169 p
(Contract NASw-2216)
(NASA-CR-131246) Avail: NTIS HC $10.50 CSCL 06B

The identification and solution of research and clinical

problems in cardiovascular medicine which were investigated by means of biomedical data transfer are reported. The following are sample areas that were focused upon by the Stanford University Biomedical Technology Transfer Team: electrodes for hemiplegia research; vectorcardiogram computer analysis; respiration and phonation electrodes; radiotelemetry of intracranial pressure; and audiotransformation of the electrocardiographic signal. It is concluded that this biomedical technology transfer is significantly aiding present research in cardiovascular medicine.
J.M.M.

N73-20054*# Scientific Translation Service, Santa Barbara, Calif.
PROBLEMS OF SPACE BIOLOGY. VOLUME 14: RADIOBIOLOGICAL ASPECTS OF THE REACTIVITY OF THE ORGANISM DURING SPACE FLIGHTS
P. P. Saksonov, ed. and B. I. Davydov, ed. Washington NASA Feb. 1973 664 p refs Transl. into ENGLISH of the book "Problemy Kosmicheskoy Biologii. Tom 14. Radiobiologicheskiye Aspekty Reaktivnosti Organizma v Svyazi s Kosmicheskimi Poletami" Nauka Press, Moscow, 1971 664 p
(Contract NASw-2035)
(NASA-TT-F-721) Avail: NTIS HC $9.00 CSCL 06B

The influence of radioprotectors on the ability of animal organisms to withstand acceleration overloads, hypoxia, space flight stress, and radiation injuries is considered. For individual titles, see N73-20055 through N73-20092.

N73-20055* Scientific Translation Service, Santa Barbara, Calif.
INFLUENCE OF RADIOPROTECTIVE PREPARATIONS FROM THE MERCAPTOALKYLAMINE GROUP (CYSTAMINE, S,BETA-AMINOETHYLISOTHIURONIUM) ON THE RESISTANCE OF ANIMALS TO TRANSVERSELY DIRECTED OVERLOADS
B. I. Davydov and N. A. Gaydamakin *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 1-30 refs (For availability see N73-20054 11-04)
CSCL 06C

Experiments were performed on 1,800 mice and 31 rats. The dose dependence of the influence of cystamine and AET on the resistance of mice to overloads was determined from the change in the frequency of cardiac contraction. Four hours following administration of radioprotectors, the resistance to overloads in the animals had returned to normal. The decrease in time of the depressant effect of cystamine and AET is associated with the elimination of the pharmacological (toxic) effect. One of the possible mechanisms for the decreased resistance of the organism to overloads under the influence of cystamine is the decrease in liver glycogen reserves. Author

N73-20056* Scientific Translation Service, Santa Barbara, Calif.
06c
INFLUENCE OF MONOSODIUM SALT OF BETA-AMINOETHYLTHIOPHOSPHORIC ACID ON THE RESISTANCE OF ANIMALS TO TRANSVERSELY DIRECTED OVERLOADS
B. I. Davydov and V. A. Kozlov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 30-42 refs (For availability see N73-20054 11-04)

The experiments were performed on 760 mice. After 30 minutes, 4 hours, 1, 2 and 5 days following intraperitoneal administration of tsistafos, the animals were subjected to overloads. The resistance of the animals to the overloads 30 minutes following administration of tsistafos is a function of the dose described by the equation of regression. Four hours and 1 to 5 days following administration of tsistafos at a dose of 300 mg/kg, the death of animals following centrifuging did not differ significantly from the death of the control animals. Author

N73-20057* Scientific Translation Service, Santa Barbara, Calif.
INFLUENCE OF RADIOPROTECTORS FROM THE AMINOTHIOL GROUP ON THE CARDIAC FUNCTION OF GUINEA PIGS UNDER THE INFLUENCE OF OVERLOADS
V. A. Kozlov and B. I. Davydov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 43-51 refs (For availability see N73-20054 11-04)
CSCL 06C

Cystamine, mercaptopropylamine and AET reduce the resistance of guinea pigs to overloads. The bradycardia they produce probably is intensified by the similar action of overloads alone and accelerates the exhaustion of the adaptation reserves during their action. AET did not affect the frequency of cardiac contractions, but under the influence of acceleration acute bradycardia and subsequent death of the animals also ensued. The influence of cystamine on heart function may be completely or partially eliminated with the aid of atropine or dimedrol.
Author

N73-20058* Scientific Translation Service, Santa Barbara, Calif.
THE MECHANISM OF REDUCED ABILITY TO WITHSTAND OVERLOADS UNDER THE INFLUENCE OF RADIOPROTECTIVE PHARMACOLOGICAL SUBSTANCES
N. A. Gaydamakin, V. G. Petrukhin, and B. I. Davydov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 52-64 refs (For availability see N73-20054 11-04)
CSCL 06R

Rats were subjected to the action of transverse overloads (30 units, 5 minutes), cystamine (75 mg/kg) or combined effect of these factors. The pathomorphological and histochemical changes in lung, liver, heart, diaphragm and adrenal were studied. The action of overloads or the administration of cystamine created a state of oxygen starvation of the tissues, and rapid consumption and exhaustion of energy reserves in the organisms of the animals. Under the combined influence of cystamine and overloads, the effect of hypoxia was cumulative. Author

N73-20059* Scientific Translation Service, Santa Barbara, Calif.
INFLUENCE OF CERTAIN RADIOPROTECTORS ON THE ABILITY OF WHITE RATS TO WITHSTAND ACUTE HYPOXIA
L. A. Tiunov, V. V. Kustov, G. A. Vasilyev, and A. N. Ukshe *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 65-70 refs (For availability see N73-20054 11-04)
CSCL 06R

The response reactions of white rats protected by means of radioprotectors to the action of acute hypoxia are studied. Cystamine (250 mg/kg), AET Br (800 and 250 mg/kg), when administered intraperitonealiy and orally, create a marked decrease in the resistance of the animals to acute hypoxic hypoxia and hypoxia created by carbon monoxide. The possible pathophysiological mechanisms of this phenomenon are discussed. Author

N73-20060* Scientific Translation Service, Santa Barbara, Calif.
CERTAIN ASPECTS OF THE PRACTICAL UTILIZATION OF MEDICINAL SUBSTANCES UNDER FLIGHT CONDITIONS
P. P. Saksonov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 71-78 refs (For availability see N73-20054 11-04)
CSCL 06E

Ideas concerning the indications and contraindications of certain medicinal substances are reported by the crew of an aircraft during flight. A brief summary of the characteristics of medical illness is presented. Author

N73-20061* Scientific Translation Service, Santa Barbara, Calif.
SENSITIVITY OF MICE TO RADIOPROTECTORS FROM THE AMINOTHIOL AND INDOLYLALKYLAMINE SERIES DURING THE PERIOD OF AFTEREFFECTS FROM TRANSVERSELY DIRECTED OVERLOADS
V. V. Antipov, M. V. Vasin, B. I. Davydov, P. P. Saksonov, and P. V. Smirnova *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 79-85 refs (For availability see N73-20054 11-04)
CSCL 06R

The influence of overloads on the sensitivity of mice to toxic doses of cystamine, AET, tsistafos and 5-MOT is studied. Immediately after centrifuging, a slight increase in the resistance of the organism to aminothiols (cystamine, tsistafos) is observed. After 30 minutes there is a statistically reliable increase in the sensitivity of the mouse to cystamine and AET; after one hour, the reaction of the animal returns to its original level. When 5-MOT is administered over 24 hours following overload increased resistance is observed. The increase in the level of the overload is accompanied by a significant increase in the resistance of the animal to the cystamine. Author

N73-20062* Scientific Translation Service, Santa Barbara, Calif.
INFLUENCE OF CERTAIN RADIOPROTECTIVE PREPARATIONS ON THE MOTOR-EVACUATORY FUNCTION OF THE

GASTROINTESTINAL TRACT OF HEALTHY AND IRRADIATED RATS

I. G. Krasnykh and L. A. Tyutin *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 86-98 refs (For availability see N73-20054 11-04)

CSCL 06R

Cystamine, AET, tsistafos and 5-MOT, when administered in optimally protective doses orally, intraperitoneally and into the large intestine, retard the evacuation of contrasting material from the stomach by 4-8, 2, 5-6 and 2-3 times, respectively. Intraperitoneal administration to an animal, prior to irradiation, of cystamine during the first few hours increases the spasms of the pylorus, intensifies disturbance of the evacuatory function of the stomach, and later normalizes the functional state of the gastrointestinal tract. Author

N73-20063* Scientific Translation Service, Santa Barbara, Calif.

CERTAIN CHARACTERISTICS OF THE ACTION OF SYMPATHOMIMETIC AMINES ON THE REFLEX FUNCTIONS OF THE CENTRAL NERVOUS SYSTEM OF IRRADIATED AND SYMPATHECTOMIZED ANIMALS

P. P. Saksonov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 99-115 refs (For availability see N73-20054 11-04)

CSCL 06C

Adrenalin, sympathol, veritol, adrenalone, ephedrine, phenamine and Pervitin preferably inhibit the reflex action of the spinal cord. The intensity and the nature of this effect bears a certain relationship to the chemical structure of the amine and the functional state of the central nervous system. The toxicity of all the amines for irradiated animals was increased by a factor of 2 to 4 in comparison to normal. The degree of inhibition of the spinal cord in irradiated animals was approximately the same as in sympathectomized animals. Author

N73-20064* Scientific Translation Service, Santa Barbara, Calif.

CHARACTERISTICS OF THE ACTION OF MEDICINAL PREPARATIONS UNDER HYPOTHERMIC CONDITIONS

B. G. Volynskiy and S. L. Freydman *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 116-132 refs (For availability see N73-20054 11-04)

CSCL 06E

Caffeine, euphyllin, cordiamin or hypothermy lead to an inhibition of respiration, a drop in the arterial blood pressure, disruption of the bioelectrical activity of the heart and metabolic processes in the organism. There is also a drop in the content of ATP and glycogen in the tissues of the heart, liver, kidneys, and brain. There is a tendency toward an increase in excretion of potassium ions from the organism in the urine. Morphine under conditions of hypothermy does not increase the inhibiting action of low temperature on the heart activity and the state of the metabolic processes in the tissues, while potassium chloride causes a sharp drop in arterial blood pressure. Adrenalin and mesaton retain the nature of their activity in hypothermy.

Author

N73-20065* Scientific Translation Service, Santa Barbara, Calif.

CHEMICAL MEANS OF PROPHYLAXIS OF RADIATION SICKNESS

V. S. Shashkov, B. V. Anisimov, and P. P. Saksonov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 133-160 refs (For availability see N73-20054 11-04)

CSCL 06R

The principal results obtained in recent years in the use of chemical substances for prophylaxis of radiation sickness both in experiments and in the clinic are reported. The possible mechanisms of action of radioprotectors are discussed. Author

N73-20066* Scientific Translation Service, Santa Barbara, Calif.

PHARMACOLOGICAL PROPERTIES OF SUBSTANCES FOR MEDICINAL PROPHYLAXIS OF RADIATION DAMAGE

V. S. Shashkov and B. V. Anisimov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 161-194 refs (For availability see N73-20054 11-04)

CSCL 06R

Data on pharmacological properties are presented for the principal and most effective radioprotectors: the aminothiols and the indolylalkylamines. The question of the toxicity of protective substances and the effective doses, behavior and physiological effects of these substances are discussed. Author

N73-20067* Scientific Translation Service, Santa Barbara, Calif.

ANTIRADIATION EFFECTIVENESS OF CYSTAMINE UNDER VARIOUS CONDITIONS OF GAMMA IRRADIATION

M. V. Vasin, P. P. Saksonov, V. V. Antipov, and V. S. Sashkov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 195-212 refs (For availability see N73-20054 11-04)

CSCL 06R

When cystamine is administered intraperitoneally to mice 5 to 10 minutes prior to gamma-irradiation (139 - 159 r/min), there is a linear dependence of the dose reduction factor (DRF) on the cystamine dose. The increase in the administration time of the preparation at 15 mg/kg to 30 minutes prior to irradiation does not have a significant influence on its protective properties. One hour later, the antiradiation activity of the protector decreases sharply. When cystamine was used in doses of 50 to 100 mg/kg, the decrease in the protector protective properties was noticed at earlier stages. With irradiation for 1.5 to 4 hours, the protective activity of cystamine, AET, tsistafos and 5-MOT decreased sharply. Author

N73-20068* Scientific Translation Service, Santa Barbara, Calif.

CHEMICAL PROTECTION AGAINST MIXED GAMMA-NEUTRON RADIATION WITH VARIOUS CONTRIBUTIONS OF NEUTRONS TO THE ABSORBED DOSE

M. V. Vasin, V. A. Kozlov, B. L. Razgovorov, and I. G. Krasnykh *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 213-221 refs (For availability see N73-20054 11-04)

CSCL 06R

Results are presented of studies on antiradiation effectiveness of cystamine, AET, tsistafos and 5-MOT in intraperitoneal administration to mice under conditions of mixed gamma-neutron irradiation with a neutron contribution to the absorbed dose of approximately 35 or 90%. Under conditions of mixed gamma-neutron irradiation with a neutron contribution to the absorbed dose of about 90%, AET and tsistafos slightly decreased the severity of radiation damage. The survival rate of the mice under these conditions was 24.2 (AET) and 26.8% (tsistafos) at LD90/30. Cystamine and 5-MOT were ineffective. In joint use of AET and tsistafos with 5-MOT, the protective properties of the aminothiols did not increase. With a drop in the contribution of the neutron component to 35%, AET, cystamine and tsistafos produced remarkable antiradiation effects, while 5-MOT did not. Author

N73-20069* Scientific Translation Service, Santa Barbara, Calif.

ELIMINATION OF CYSTAMINE IN THE ORGANISM AND THE PROLONGATION OF ITS RADIOPROTECTIVE EFFECT

B. I. Davydov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 222-257 refs (For availability see N73-20054 11-04)

CSCL 06R

A method is proposed for determining the elimination of the toxic effect of cystamine. In the first approximation, the rate of elimination of this radioprotector in the first three hours amounts to about 25 to 35% per hour. An attempt was made to prolong the radioprotective effect by adding the eliminated dose of cystamine. It was thus possible to maintain the radioprotective level of the first dose up to two hours. Elimination of cystamine through additional multiple administration of small doses with an interval of one hour proceeds with a drop in its rate with each subsequent administration. The decrease in the radioprotective effect of the cystamine proceeds more rapidly than its toxic effect is eliminated. Author

N73-20070* Scientific Translation Service, Santa Barbara, Calif.

INFLUENCE OF GAMMA RADIATION ON THE ELIMINATION OF THE TOXIC EFFECT OF CYSTAMINE

M. V. Vasin, B. I. Davydov, V. V. Antipov, and P. P. Saksonov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 258-266 refs (For availability see N73-20054 11-04)

CSCL 06R

The time of half-elimination (T sub 50) of the toxic effects of cystamine is compared in irradiated and nonirradiated mice. The residual dose of cystamine three hours following administration of the preparation based on the change in the protector LD50 was calculated. With prophylactic use of cystamine, gamma irradiation at a dose of 850 r led to an increase in sub 50 from 1.8 (1.6 - 2.0) hours in intact mice to 2.3 (2.0 2.6) hours in irradiated animals. Three hours after preparation was

used, the residual dose of cystamine was 44.2% in the irradiated mice and 24.5% of the original value in the nonirradiated animals. It is suggested that lengthening the elimination time of the toxic effect of cystamine under the influence of radiation is due to the decrease in the protector metabolism intensity under these conditions. Author

N73-20071* Scientific Translation Service, Santa Barbara, Calif.
INFLUENCE OF SHIELDING CERTAIN PARTS OF THE BODY ON RADIATION SICKNESS AND SURVIVAL OF ANIMALS WITH TOTAL GAMMA-NEUTRON IRRADIATION
B. L. Razgovorov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 267-287 refs (For availability see N73-20054 11-04)
CSCL 06R

In experiments on rats subjected to total gamma neutron irradiation with a neutron component of approximately 90%, it was found that with equal masses of protected tissue the effectiveness of shielding the head is much less than the effect of shielding the anterior part of the stomach. The effect of shielding equal masses of tissue of the stomach and head under the influence of fission neutrons with an average energy of approximately 1 MeV is close to the effect of shielding these same regions of the body with irradiation with protons with an energy of 120 MeV and is considerably worse than the effect of shielding for gamma irradiation. With a total gamma-neutron irradiation, the drop in the neutron contribution to the absorbed dose from 90 to 35% leads to a considerable increase in the effectiveness of shielding the head and stomach. Author

N73-20072* Scientific Translation Service, Santa Barbara, Calif.
CHANGE IN REACTIVITY OF ANIMALS TO CERTAIN PHARMACOLOGICAL PREPARATIONS WITH PARTS OF THE BODY SHIELDED DURING TOTAL IRRADIATION
B. L. Razgovorov, P. P. Saksonov, V. V. Antipov, V. S. Shashkov, and V. S. Morozov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 288-306 refs (For availability see N73-20054 11-04)
CSCL 06R

In experiments on rats, cystamine, AET, and 5-methoxytryptamine was studied with shielding of the stomach and head under conditions of general irradiation with proton energies of 120 MeV and gamma rays from Co-60. The effectiveness of these preparations was considerably increased, especially when the substances were used in doses that were reduced relative to the optimum together with slightly effective shieldings, with absolutely lethal doses of radiation on the animals. While in the case of cystamine and AET an increase in the specific effectiveness was the same, both for shielding the head and for the tissue of the stomach, in the case of 5-methoxytryptamine with shielding of the stomach the increase in its effectiveness was much more pronounced than with shielding of the head. Author

N73-20073* Scientific Translation Service, Santa Barbara, Calif.
INFLUENCE OF SHIELDING CERTAIN PARTS OF THE BODY ON THE COURSE OF RADIATION SICKNESS IN DOGS WITH TOTAL GAMMA IRRADIATION
B. L. Razgovorov and N. I. Konnova *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 307-329 refs (For availability see N73-20054 11-04)
CSCL 06R

In an experiment on dogs which were subjected to total gamma irradiation at lethal doses, the influence of shielding the head and the anterior part of the stomach on the clinical course and outcome of radiation sickness was studied. The experiment results supported the basic data obtained in experiments on small laboratory animals and showed the high effectiveness of shielding a part of the body in dogs. In protecting various masses of tissue with shieldings that provided equal attenuation of the radiation and with an equal dose of radiation, shielding of parts of the anterior portion of the stomach was much more effective than shielding the head. Author

N73-20074* Scientific Translation Service, Santa Barbara, Calif.
EFFECT OF SHIELDING THE STOMACH ON THE FREQUENCY OF CHROMOSOMAL ABERRATIONS IN THE CELLS OF THE MARROW OF GUINEA PIGS AND RATS WITH GAMMA-IRRADIATION AT DOSES OF 50-200 r
M. V. Vasin and B. L. Razgovorov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 330-338 refs (For availability see N73-20054 11-04)
CSCL 06R

Twelve and 24 hours after irradiation at doses of 40 to 200 r, the authors failed to find any significant differences in the disruption of the chromosomal complex of the marrow cells in experimental (shielded stomach) and control animals with radiation. However, after three days the frequency of chromosomal aberrations in the marrow of the experimental animals had practically returned to the original level and was statistically reliably lower than in the animals that were irradiated without physical protection. The disruption of the chromosomal complex in the experimental animals was also slightly lower than in the animals that were irradiated with half the dose of radiation, which indicates a decrease in the radiation effect by 2 to 2.5 times. Author

N73-20075* Scientific Translation Service, Santa Barbara, Calif.
AMINOTRANSFERASES OF THE BLOOD SERUM OF DOGS FOLLOWING TOTAL EXPOSURE TO GAMMA RAYS WITH THE STOMACH OR HEAD SHIELDED
B. I. Davydov and Ye. Ye. Simonov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 339-358 refs (For availability see N73-20054 11-04)
CSCL 06R

In the serum of the blood of dogs subjected to a single irradiation with Co-60 at a dose of 600 r (2.9 r/min) with protection of the head or stomach, the activity of glutaminoaspartic (GAST) and glutaminoalanic (GALT) aminotransferase was investigated. Hyperfermentemia was observed from 40 to 90 days. Exposure to radial acceleration (to the point of disruption of cardiac activity) causes uniform hyperfermentemia in intact dogs and in those irradiated with the stomach shielded and no changes in GALT and GAST activities in dogs with shielding of the head. These differences were explained by the changes in the activity of aminotransferase, and the rate and volume of the reparative processes of different shielding conditions. Author

N73-20076* Scientific Translation Service, Santa Barbara, Calif.
PATHOMORPHOLOGICAL CHANGES IN THE ORGANS OF WHITE RATS FOLLOWING IRRADIATION BY PROTONS WITH AN ENERGY OF 120 MeV AND THE ROLE OR PARTIAL SHIELDING IN THE ATTENUATION OF RADIATION DAMAGE
L. S. Sutulov, N. A. Gaydamakin, B. L. Razgovorov, P. P. Saksonov, V. G. Petrukhin, V. V. Antipov, V. N. Kopyev, N. A. Bogdanova, N. V. Trukhina, Yu. L. Sutulov et al *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 359-379 (For availability see N73-20054 11-04)
CSCL 06R

Rats were irradiated with protons having an energy of 120 MeV at a dose of 640 rads with partial shielding of the stomach. A pathomorphological investigation was carried out on the spleen, testes, stomach, intestine, myocardium, central and peripheral nervous system, and retina. In the irradiated animals destructive changes typical for radiation sickness were found, not only in the radiosensitive organs, but also in the so-called radioresistant ones (myocardium, nervous system). Local protection of the stomach reduced the depth and severity of changes in the organs, especially the ones directly covered by the shielding. Author

N73-20077* Scientific Translation Service, Santa Barbara, Calif.
SIGNIFICANCE OF RADIOSENSITIVITY OF INDIVIDUAL PARTS OF THE BODY IN THE DEVELOPMENT OF RADIATION PATHOLOGY
N. A. Gaydamakin *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 380-399 refs (For availability see N73-20054 11-04)
CSCL 06R

Male rats were subjected to total gamma-neutron irradiation at a dose of 300 rads (neutron contribution about 90%) with the head and stomach protected by a shielding. The test data included mortality, frequency of diarrhea, the nature of the pathomorphological changes in the organs and the degree of recovery of the reproductive function in the irradiated males. In the rats subjected to total gamma-neutron radiation the characteristic feature of radiation sickness was earlier damage to the intestine. Placing the screen over the stomach is a more

effective means of antiradiation protection than over the region of the head. Author

N73-20078* Scientific Translation Service, Santa Barbara, Calif.
CERTAIN METHODS OF PROPHYLAXIS OF RADIATION SICKNESS
L. A. Tyutin *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 400-409 refs (For availability see N73-20054 11-04)
CSCL 06R

Administration of 0.6 g of cystamine hydrochloride to a patient who had undergone radiation treatment prior to each exposure reduces by two to three times the frequency of development of various symptoms of radiation sickness. The prescription of a complex of B vitamins and vitamin C during radiation therapy has a favorble effect on the total condition of the patients, reduces some symptoms of intoxication, but does not have a noticeable influence on the white blood picture. Author

N73-20079* Scientific Translation Service, Santa Barbara, Calif.
REACTIVITY OF IRRADIATED ANIMALS SHIELDED BY MERCAPTO-(CYSTAMINE AND TSISTAFOS) AND INDOLYLALKYLAMINES (5-MOT AND SEROTONIN) TO TRANSVERSELY DIRECTED OVERLOADS
B. I. Davydov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 410-437 refs (For availability see N73-20054 11-04)
CSCL 06R

In experiments on 2610 mice, the reaction (death) to overloads (44 units) at various periods of radiation sickness at gamma radiation doses from 500 to 4,000 r was studied. Equations of regression were computed for the tolerance of overloads by irradiated animals with the use of radioprotectors. Author

N73-20080* Scientific Translation Service, Santa Barbara, Calif.
RATE OF RECOVERY OF RADIORESISTANCE WITH THE COMBINED APPLICATION OF IONIZING RADIATION AND DYNAMIC FLIGHT FACTORS ON THE ORGANISM
N. N. Dobrov, V. A. Kozlov, V. S. Parshin, and P. P. Saksonov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 438-461 refs (For availability see N73-20054 11-04)
CSCL 06R

In experiments on mice, radioresistance recovery rate was studied with combined exposure to radiation and dynamic factors (vibration, acceleration), based on criteria for the change of LD50/30 and AD50/4 (the dose causing a drop in the weight of the spleen by 50% in four days after the test irradiation). A lengthening of the half-recovery period of radioresistance was observed in mice that were subjected to the combined action of radiation and dynamic factors (acceleration, vibration) in comparison to those that were simply irradiated. Author

N73-20081* Scientific Translation Service, Santa Barbara, Calif.
INFLUENCE OF CYSTAMINE COMBINED WITH SYMPATHOMIMETIC AMINES ON REPARATIVE PROCESSES FOLLOWING THE ACTION OF RADIATION AND OVERLOADS
N. N. Dobrov, V. A. Kozlov, V. S. Parshin, and P. P. Saksonov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 462-467 (For availability see N73-20054 11-04)
CSCL 06R

The experiments were performed on 2410 white mice. Before and after irradiation, the animals were subjected to overloads. As the protector, cystamine was used mixed with adrenalin and phenamine. As a criterion for evaluating the protective effect, the reparation rate of the reversible portion of radiation damage was used, determined by the half-recovery period of radioresistance in the animals. It was found that, with combined radiation, cystamine has a protective effect of approximately the same degree as with a single irradiation. Author

N73-20082* Scientific Translation Service, Santa Barbara, Calif.
MAGNITUDE OF THE IRREVERSIBLE PORTION OF RADIATION DAMAGE WITH THE COMBINED ACTION OF RADIATION AND ACCELERATION
N. N. Dobrov, V. A. Kozlov, V. S. Parshin, and N. I. Yezepchuk *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 468-475 refs (For availability see N73-20054 11-04)
CSCL 06R

In experiments on 430 white mice, studies were carried out involving a quantitative determination of the relative value of the irreversible component of radiation damage under the combined action of gamma radiation and acceleration. After preliminary irradiation in sublethal doses up to a total dose of 800 r, or the combined action of radiation in the same doses and acceleration, changes remained in the organism that reduced its radioresistance and resistance to the combined action of radiation and acceleration. Under conditions of combined radiation and acceleration, the value of the irreversible part of the radiation damage increases by 3.5 - 9%. Author

N73-20083* Scientific Translation Service, Santa Barbara, Calif.
REACTION OF THE PERIPHERAL BLOOD IN DOGS UNDER THE COMPLEX ACTION OF TRANSVERSE OVERLOADS AND GAMMA IRRADIATION
N. I. Konnova *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 476-495 refs (For availability see N73-20054 11-04)
CSCL 06R

In experiments on 31 dogs, the influence exerted on the blood system was studied by the complex action of single preliminary transverse overloads and gamma radiation at a dose of 100 or 200 r with intervals between exposures of two hours or 24 hours. With an interval of two hours and a radiation dose of 100 r, the changes in the peripheral blood during the first hours and days were caused by the overload and consisted of neutrophilic leucocytosis, lympho-, eosino- and thrombocytopenia. With an increase of the dose to 200 r, this effect became less pronounced. With an interval between the influences of several days and a dose of 100 and 200 r, a more rapid and complete restoration of the peripheral blood composition was found. Author

N73-20084* Scientific Translation Service, Santa Barbara, Calif.
EVALUATING THE INFLUENCE OF VIBRATION ON THE RADIATION REACTION IN DOGS WITH THE AID OF CERTAIN CLINICAL-HEMATOLOGICAL INDICES
T. S. Lvova *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 496-511 refs (For availability see N73-20054 11-04)
CSCL 06R

The experiments were performed on 33 mongrel male dogs. The animals were vibrated (70 Hz, 0.4 cm amplitude) for a single period prior to irradiation with an interval between exposures of 2 or 24 hours. It was shown that the vibration changes the reaction of the peripheral blood to irradiation. The effect of vibration was most clearly evidenced in the group with the two-hour interval between the exposures on the first day of observation. The increase in the radiation dose to 200 r slightly reduced the effect of vibration. The increase of the interval between exposures to 24 hours both at the 100 r and 200 r doses led to the disappearance of the vibration effect. Author

N73-20085* Scientific Translation Service, Santa Barbara, Calif.
INFLUENCE OF PRELIMINARY ADMINISTRATION OF THE RADIOPROTECTOR FINAM ON THE REACTIVITY OF THE TISSUES OF IRRADIATED ANIMALS UNDER VARIOUS EXPERIMENTAL CONDITIONS
L. S. Sutulov, P. P. Saksonov, M. N. Volkov, V. A. Kozlov, Yu. L. Sutulov, A. P. Kuzmina, N. N. Dobrov, A. G. Krasnolobov, V. N. Ananina, L. V. TruKhina et al *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 511-546 refs (For availability see N73-20054 11-04)
CSCL 06R

The role of the radioprotector, finam, which belongs to the aminothiols, is studied reducing the degree of morphological change in the internal organs of irradiated animals. The influence of the radioprotector on the tissue structure of the myocardium during the first 1.5 months of radiation sickness was analyzed. The course of the regenerative process in the sciatic nerve of the irradiated animals, the processes of recovery and morphological adjustment in various tissues and organs at remote periods following double gamma irradiation, and combined exposure to overloads and radiation are also considered. Author

N73-20086* Scientific Translation Service, Santa Barbara, Calif.
INFLUENCE OF PHARMACOCHEMICAL SUBSTANCES ON THE REACTIVITY OF THE ORGANISM TO THE COMBINED ACTION OF GAMMA RADIATION AND TRANSVERSE OVERLOADS

N. A. Gaydamakin, S. G. Kulkin, B. I. Davydov, and V. S. Shashkov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 547-569 refs (For availability see N73-20054 11-04)
CSCL 06R

Under the combined exposure of mice to gamma radiation from Co-60 in doses of 350 and 700 r and transverse overloads (10 units, 30 minutes), the effectiveness of cystamine and AET in amounts of 75 mg/kg each was studied. The effect of overloads 24 hours prior to irradiation reduces the radiation damage of hemopoietic organs. In mice that were subjected to the action of overloads 24 hours after irradiation, there was an insignificant increase in the radiation damage to the spleen and marrow and an increase in the destructive changes in the peripheral nervous system. Cystamine combined with AET has an antiradiation protective effect. Author

N73-20087* Scientific Translation Service, Santa Barbara, Calif.
THE PROBLEM OF THE RESISTANCE OF EXPERIMENTAL ANIMALS TO ACUTE HYPOXIA AT VARIOUS STAGES OF RADIATION SICKNESS
G. A. Vasilyev, L. A. Tiunov, Yu. A. Medvedev, V. V. Kustov, and A. N. Ukshe *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 570-578 refs (For availability see N73-20054 11-04)
CSCL 06R

In experiments on white rats, the influence of X-radiation on the resistance of the animals to anoxic, anemic and histotoxic hypoxia was studied. At the same time, the histophysiological state of the adrenal cortex was considered. Increased resistance of the irradiated rats to hypoxia was caused by the nonspecific reaction of the organism to the stress effect, realized through the adrenal cortex. Author

N73-20088* Scientific Translation Service, Santa Barbara, Calif.
STATE OF THE PERIPHERAL BLOOD OF IRRADIATED ANIMALS UNDER PROLONGED CONDITIONS OF REDUCED BAROMETRIC PRESSURE
N. I. Yezepchuk and N. N. Dobrov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 579-590 refs (For availability see N73-20054 11-04)
CSCL 06S

Radiation reactions (450 r) of rats kept at reduced barometric pressure (198 mm Hg, altitude 10,000 m, partial pressure of oxygen close to that on the ground were studied). The conditions of reduced barometric pressure had a negative effect on the survival rate of the irradiated rats. The preliminary acclimatization of the animals to the altitude slightly modified the effect of radiation sickness. There were no significant differences in the blood indices in the acclimatized and nonacclimatized rats that were irradiated. Author

N73-20089* Scientific Translation Service, Santa Barbara, Calif.
METHOD OF MEASURING THE COMPOSITION AND INTENSITY OF THE HEAVY COMPONENT OF COSMIC RADIATION c29
M. D. Nikitin, V. P. Perelygin, and S. P. Tretyakova *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 591-601 refs (For availability see N73-20054 11-04)
CSCL 03B

For impact calculation of heavy nuclei on a target, a method was worked out for determining them based on residual path lengths in nuclear emulsions using the threshold development mode. The stage of preliminary saturation of irradiated emulsions Type P-8 in solutions of potassium bromide with various concentrations provides the threshold development of particle tracks over a broad range of specific energy losses of gamma particles up to Ar-40 ions. Author

N73-20090* Scientific Translation Service, Santa Barbara, Calif.
METHOD OF COMBINED TISSUE BLOCKS FOR COMPARATIVE PATHOMORPHOLOGICAL STUDY OF RADIATION PATHOLOGY
V. G. Petrukhin and N. A. Gaydamakin *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 602-615 refs (For availability see N73-20054 11-04)
CSCL 06R

An organ removed from an animal of one group is attached to filter paper together with a similar organ, removed from an animal from another group. The combined tissue block is frozen in dry ice, and combined sections are then prepared in a cryostat for histochemical study. The same blocks, without preliminary freezing, are placed in corresponding fixers (solutions of formalin, Carnot, susa, etc.), dehydrated and sealed with media providing preparations for analysis by ordinary histological methods. Author

N73-20091* Scientific Translation Service, Santa Barbara, Calif.
PROBLEM OF RELATIVE BIOLOGICAL EFFECTIVENESS OF FAST NEUTRONS
B. L. Razgovorov *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 616-643 refs (For availability see N73-20054 11-04)
CSCL 06R

Experiments carried out on animals showed that if the contribution of gamma radiation to the total radiation dose is not more than 10 - 15%, the level of the gamma background of the RBE of the neutrons may be disregarded. With a higher contribution of gamma radiation to the total radiation dose, the error in determining the RBE coefficient increases significantly and may noticeably distort the results of the study. A table of total doses of gamma-neutron irradiation for two values of the gamma background is included, which facilitates the determination of the neutron RBE coefficient with allowance for gamma radiation. Author

N73-20092* Scientific Translation Service, Santa Barbara, Calif.
EXCRETION OF FREE AMINO ACIDS WITH THE URINE AS A TEST FOR EARLY DIAGNOSIS OF RADIATION DAMAGE
L. A. Tyutin *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 644-653 refs (For availability see N73-20054 11-04)
CSCL 06R

In the case of 30 individuals who were subjected to combined radiation therapy for treatment of cancer of the uterus, the excretion of free amino acids with the urine and the change in their level in the blood were studied. The increase in amount of several free amino acids in the urine is an early and sensitive indicator of radiation action on the human organism. Author

N73-20093*# Scripta Technica, Inc., Washington, D.C.
CHANGES OF CELL ENZYMES, GLUCOSE, CHOLESTEROL AND 17-HYDROXYCORTICOSTEROIDS IN BLOOD DURING PHYSICAL EXERCISE AS A FUNCTION OF THE PHYSICAL TRAINING STATUS
G. Brockkoetter NASA Apr. 1973 32 p refs Transl. into ENGLISH "Das Verhalten von Zellenzymen, glucose, cholesterin and 17-hydroxy-Corticosteroiden im Blut unterkorperlicher Arbeit in Abhangigkeit vom Trainingzustand", West German report DLR-FB-72-48, Porz-Wahn, 1972 52 p
(Contract NASw-2036)
(NASA-TT-F-14826; DLR-FB-72-48) Avail: NTIS HC $3.75
CSCL 06S

In 11 untrained and 11 highly trained subjects, the alterations of cell enzymes, glucose, cholesterol and 17-OH-corticosteroids were studied in response to physical exercise and as a function of the physical status. The training status was quantified by measuring the maximum oxygen uptake. The two groups of subjects showed differences in their responses to physical exercise with respect to aldolase, glucose and 17-OH-corticosteroids. There was no evidence for a close relationship between the status of physical fitness and the extent of the observed alterations. However, a significant coefficient ($r = 0.628$) was found for the correlation between the maximum oxygen uptake and the plasma aldolase values at rest. Author

N73-20094# Joint Publications Research Service, Arlington, Va.
SPACE BIOLOGY AND MEDICINE, NO. 1, 1973
2 Apr. 1973 144 p refs Transl. into ENGLISH of Kosm. Biol. Med. (USSR), no. 1, 1973
(JPRS-58620) Avail: NTIS HC $9.25

Articles are presented concerning the selection and training of cosmonauts; evaluation and analysis of accumulated data to facilitate the on-going transition from orbital to interplanetary flights; research for guaranteeing safety on long flights, and reliability of the human components of the man-spaceship system; space psychology and physiology; environmental problems and control (spacecraft habitability, effects of radiation and weightless-

ness, etc.) and telemetry. For individual titles, see N73-20095 through N73-20115.

N73-20095 Joint Publications Research Service, Arlington, Va.
PHYSIOLOGICAL EFFECT OF THE REPLACEMENT OF ATMOSPHERIC NITROGEN BY INERT GASES AT HIGH AND LOW TEMPERATURE
A. G. Dianov, V. V. Isayenko, and G. P. Sviridova *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 1-10 refs (For availability see N73-20094 11-04)

The effect of extreme (death causing) temperature exposures in helium-oxygen or argon-oxygen atmospheres was studied in 153 experiments on rats. At high and low ambient temperatures the replacement of nitrogen with helium produced a negative effect, shortening the lifetime of the animals. This effect can be attributed to a substantial change in heat transfer in the helium-oxygen atmosphere which occurs due to the higher heat conductivity of helium in comparison with nitrogen. At high and low ambient temperatures the replacement of nitrogen with argon caused no significant changes; the heat conductivity of nitrogen and argon is similar. It is concluded that human tolerance of extreme temperature effects in atmosphere in which nitrogen is replaced by inert gases is dependent only on their thermophysical properties. Author

N73-20096 Joint Publications Research Service, Arlington, Va.
EFFECT OF ANTIOXIDANTS ON THE RATE OF DEOXYGENATION OF BLOOD IN ANIMALS EXPOSED TO A MODIFIED ATMOSPHERE
Ye. Ya. Kaplan, V. I. Shubin, and I. M. Epshteyn *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 11-19 refs (For availability see N73-20094 11-04)

By means of polarographic coulombmetry, the effect of hypoxia and hyperoxia on the rate of blood deoxygenation and the influence of antioxidants (mexamine and BH-3) in mice were studied. The rate of blood deoxygenation increased in response to intraperitoneal injections of antioxidants under normal, hypoxic and hyperoxic conditions. These drugs were found to affect the blood directly, penetrating through the red blood cell membranes. It is postulated that the mechanism of action of antioxidants on the dissociation of oxyhemoglobin is related to their capacity to change the hydrogen ion concentration in the plasma and within red blood cells. Author

N73-20097 Joint Publications Research Service, Arlington, Va.
DYNAMICS OF NITROGENOUS CEREBRAL METABOLITES ACCOMPANYING MULTIPLE HYPOTHERMIA AND SUBSEQUENT SELF HEATING
E. Z. Emirbekov *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 20-24 refs (For availability see N73-20094 11-04)

The content of ammonia, glutamine, glutamic, gamma aminobutyric and aspartic acids in the brain of rats was studied after 1-, 7-, 12- and 13-fold hypothermia to 20-19 C and subsequent self-heating to 37-37.5 C. Following repeated hypothermia and self-heating, a new level of the concentration of nitrogen metabolites was reached in the brain of rats. An increased ammonia content persisted for several days after self-heating. The concentration of glutamine, glutamic and aspartic acids decreased by 18.8, 16.5 and 11.5 percent respectively in comparison with the control data. Author

N73-20098 Joint Publications Research Service, Arlington, Va.
WATER MINERAL METABOLISM IN ANIMALS SUBJECTED TO RESTRICTED MOBILITY
Yu. Yu. Osipov and V. S. Shashkov *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 25-31 refs (For availability see N73-20094 11-04)

The effect of hypokinesis of varying duration on fluid-electrolyte metabolism and composition in the blood and tissues of animals was studied. The exposure caused a significant increase in diuresis and mineral excretion but induced no changes in blood electrolyte composition. After the exposure, diuresis and sodium and potassium excretion decreased substantially. The fact of increased diuresis in the absence of dehydration symptoms may give evidence that it develops due to latent fluid losses. This change in fluid excretion may be related to motor-renal reflexes or disturbances in protein metabolism, particularly accelerated excretion of protein metabolites. Author

N73-20099 Joint Publications Research Service, Arlington, Va.
INCREASE IN THE TOLERANCE OF RATS TO A HIGH TEMPERATURE UNDER THE INFLUENCE OF THERMAL CONDITIONING AND DRUGS
A. Yu. Yunusov, E. S. Makhmudov, and F. M. Islamgaliyeva *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 32-37 refs (For availability see N73-20094 11-04)

The high temperature tolerance of rats was studied under normal conditions and after thermal conditioning, combined with adaptogenic drug administration. The thermal tolerance of rats was significantly increased by administration of glycyrrhetic acid (1 mg) in combination with succinic and ascorbic acids and potassium chloride (1 mg of each) for 10 days under normal conditions and after thermal conditioning. By the time of death the experimental animals exhibited an increase in adrenal weight, rectal temperature and urine excretion of potassium and (especially) sodium, induced by thermal conditioning. Possible mechanisms for increasing the thermal tolerance of animals under the influence of adaptogenic drugs are discussed. Author

N73-20100 Joint Publications Research Service, Arlington, Va.
EFFECT OF CHRONIC IRRADIATION OF DOGS BY Co60 GAMMA RAYS ON THE LEVEL OF AUTOANTIBODIES
V. A. Zuyeva *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 38-44 refs (For availability see N73-20094 11-04)

Dogs were exposed to chronic irradiation with Co-60 gamma rays during 2.5 years with doses of 25 rem (first group) and 150 rem (second group) and combined irradiation with a dose of 75 rem per year supplemented with short-term exposure with a dose of 50 rem three times a year (third group). Chronic irradiation of dogs in the second and third groups induced the following changes in immunobiologic reactivity: an increase in the titers of incomplete (the direct Coumb's method) and complement-fixing (the complement consumption reaction) autoantibodies. The dogs in the first group exhibited no differences in these indices in comparison with the controls. Author

N73-20101 Joint Publications Research Service, Arlington, Va.
MORPHOLOGICAL CHANGES IN THE LIVER IN DOGS ACCOMPANYING CHRONIC GAMMA RADIATION
Ye. A. Savina, V. K. Podymov, G. I. Plakhuta-Plakutina, V. I. Yakovleva, and B. A. Markelov *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 45-51 refs (For availability see N73-20094 11-04)

Thirty dogs were exposed to chronic doses of 21, 62.5 and 125 rad/year and combined chronic exposure with a dose of 62.5 rad/year, and acute exposure with doses of 58 and 126 rad/year gamma irradiation over a three-year period. Morphological changes in the liver of these dogs were detected in a study of 210 liver biopsies (150 experimental and 60 control animals). The changes developed in relation to the duration and pattern of irradiation. Author

N73-20102 Joint Publications Research Service, Arlington, Va.
PROLIFERATIVE ACTIVITY OF BONE MARROW CELLS IN DOGS DURING CHRONIC GAMMA IRRADIATION IN COMBINATION WITH REPEATED ACUTE EXPOSURES
T. M. Zukhbaya *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 52-56 refs (For availability see N73-20094 11-04)

The proliferative activity of bone marrow cells of dogs exposed to three-year chronic gamma irradiation (dose rate of 63 rad per year), in combination with repeated acute irradiation (with a dose of 42 rad for 20 hours each), was examined. The total mean tissue dose was 570 rad. The proliferative activity of the erythroblasts remained undisturbed. Leukoblasts exhibited an inhibition of regenerative processes. At the end of the experiment an increased mitotic activity of myeloid elements was observed together with a significant decline in a number of myeloid cells in the bone marrow and a decrease in the number of leukocytes in the peripheral blood. Author

N73-20103 Joint Publications Research Service, Arlington, Va.
DYNAMICS OF SOME CHARACTERISTICS OF INDUCED POTENTIAL OF THE OPTICAL REGION IN THE CEREBRAL

CORTEX IN RABBITS UNDER CONDITIONS OF INCREASING HYPOXIA

I. N. Zakharova *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 57-61 refs (For availability see N73-20094 11-04)

When taken to an altitude of 5,000-7,000 m at a rate of 25 m/sec, rabbits exhibited a significant shortening of the latent period and the amplitude of the primary response of the induced potential to light flashes. When taken to an altitude of over 8,000-9,000 m they exhibited an increase in these parameters. The data obtained give evidence that during the first of the hypoxic stages the excitation process prevails, whereas during the second stage an inhibition process develops in brain structures. Author

N73-20104 Joint Publications Research Service, Arlington, Va.
CHANGES IN COMPOSITION OF THE PERIPHERAL BLOOD DURING 18- AND 24-DAY SPACE FLIGHTS

V. I. Legenkov, I. S. Balskhovskiy, A. V. Beregovkin, Z. S. Moshkalo, and G. V. Sorokina *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 62-69 refs (For availability see N73-20094 11-04)

The morphological composition of the peripheral blood of crew members of the Soyuz-9 spacecraft and Salyut-1 space station was studied. The investigations revealed transient moderate neutrophilic leukocytosis, a relative decrease in the count of lymphocytes and monocytes, a pronounced decrease in the count of eosinophils, and a slight decline in hemoglobin and thrombocytopenia that was distinct after the long-term flight. Changes were revealed in the protein fractions whose nature was unclear, appearance of the C-reactive protein, and acceleration of the erythrosedimentation rate. These changes indicate the effect of space flight factors on the functional state of the blood-forming system. Methods for making such studies and recommendations on their continuation are presented. Author

N73-20105 Joint Publications Research Service, Arlington, Va.
CHANGE IN BLOOD CONTENT OF GASES WHEN MAN IS EXPOSED TO HIGH AMBIENT TEMPERATURES

A. N. Azhayev and V. S. Panchenko *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 70-77 refs (For availability see N73-20094 11-04)

During experiments in an altitude chamber the test subjects remained at rest or performed moderate physical exercises, the temperature of the air and walls being 60 and 70 C. Within an increase in body temperature by 1 deg no changes in the partial pressure of oxygen and carbon dioxide in the blood were found. When there was considerable hyperthermia (an increase in body temperature by 2 deg) the partial pressures of oxygen and carbon dioxide decreased significantly. This dropoff was evidently induced by hemodynamic disturbances during overheating and the consequences of pulmonary hyperventilation. Author

N73-20106 Joint Publications Research Service, Arlington, Va.
CARBON MONOXIDE CONTENT IN EXHALED AIR AND BLOOD CARBOXYHEMOGLOBIN IN SUBJECTS CONFINED TO INSULATING PROTECTIVE GEAR

C. M. Gorodinskiy, A. V. Sedov, M. I. Vakar, G. Ye. Mazneva, N. A. Surovtsev, Ye. Ye. Sotnikov, and L. I. Kobzeva *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 78-83 refs (For availability see N73-20094 11-04)

The content of carbon monoxide in the exhaled air and carboxyhemoglobin in the blood was measured in test subjects who performed heavy physical work for six hours in a pure oxygen atmosphere at a reduced pressure. The carbon monoxide content was found to decrease. A distinct correlation was established between the carbon monoxide concentration in the exhaled air and the carboxyhemoglobin content in the blood. Author

N73-20107 Joint Publications Research Service, Arlington, Va.
STATE OF HEMOCOAGULATION AND THROMBOCYTES DURING HYPOKINESIA AFTER ADAPTATION TO HIGH MOUNTAIN CONDITIONS

V. A. Isabayeva and T. A. Ponomareva *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 84-91 refs (For availability see N73-20094 11-04)

Short-term adaptation of test subjects to an elevation of 3,200 m produced phasic changes in hemocoagulation and thrombocytes which included a relative decrease in blood-coagulating capacity and a progressive increase in the thrombocyte count. Further 10-day hypokinesia of test subjects preadapted to high altitude induced no disturbances in their coagulation system. Prolonged 24-day hypokinesia resulted in relative hypocoagulation (dropoff in plasma tolerance to heparin, increase in recalcification time), and decrease in the thrombocytogram. It was demonstrated that preliminary adaptation to high elevations can smooth marked shifts in hemocoagulation brought about by hypokinesia in untrained people. Author

N73-20108* Joint Publications Research Service, Arlington, Va.
FUNCTIONAL CHANGES IN SYSTEMIC AND REGIONAL (INTRACRANIAL) CIRCULATION ACCOMPANYING LOW ACCELERATIONS

V. V. Usachev and I. P. Shinkarevskaya *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 92-101 refs (For availability see N73-20094 11-04)

Functional changes in systemic and cerebral hemodynamics were studied with respect to vestibular stresses. The main types of responses, differing qualitatively with respect to the tolerance of test subjects to low accelerations (particularly to Coriolis accelerations), were established. This is of practical importance in the selection of aircraft and space pilots. The data presented sheds light on the physiological mechanisms of adaptation and disturbed compensation during vestibular stimulation. Further studies in this important field of aerospace medicine are outlined. Author

N73-20109 Joint Publications Research Service, Arlington, Va.
ROLE OF SOCIAL SYNCHRONIZERS IN ADAPTATION TO UNUSUAL DAILY SCHEDULES c05

S. I. Stepanova *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 102-111 refs (For availability see N73-20094 11-04)

A series of experiments was conducted with inversion of the diurnal sleep and wakefulness regime of subjects under isolation conditions. Adaptation of the subjects to the inverted schedule was attained using different social synchronizers, the most important of which was the work and rest schedule. In addition to the work and rest regime, other social synchronizers used included radio transmissions recorded on magnetic tape and relayed into the isolation chamber. The time of day given by the announcer at the beginning of each transmission coincided with the subjective time of the subjects. The results of the experiments show that a knowledge of the true time of day does not preclude adaptation of subjects isolated in a chamber to the inverted diurnal rhythm, although it can be speculated that it makes such adaptation difficult. D.L.G.

N73-20110 Joint Publications Research Service, Arlington, Va.
BACTERICIDAL ACTIVITY OF THE HUMAN SKIN AT DIFFERENT TIMES OF DAY

M. I. Kozar *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 112-117 refs (For availability see N73-20094 11-04)

The bactericidal activity was investigated of the human skin at different times of day in the case of a normal diurnal work and rest regime. The bactericidal activity was determined in the middle third of the forearm and palm one to two hours after eating and not sooner than two hours after ordinary hygienic processing of skin on the arms. The results indicate the following: (1) Skin bactericidal activity on the forearm is greater in the morning hours; in the evening hours it is depressed. (2) The differences in bactericidal activity on forearm skin, determined at different times of day, are reliable. (3) Skin bactericidal activity on the palm is usually higher in the morning hours. (4) During the evening hours the capacity of the skin to inactivate an applied suspension of enteric bacilli is reduced. D.L.G.

N73-20111 Joint Publications Research Service, Arlington, Va.
IMPORTANCE OF PHOTOSTIMULATION IN THE ELECTROENCEPHALOGRAPHIC STUDY OF FLIERS AND CANDIDATES AT FLIGHT SCHOOLS

H. R. Kammel *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 118-125 (For availability see N73-20094 11-04)

In order to determine the importance of photostimulation in

a study of readiness for flight service, systematic electroencephalographic investigations were carried out using intermittent light stimuli. The subjects used in the investigations included candidates for flight schools, students at flight schools, and flight personnel. A control group consisted of military personnel with functional disorders of the nervous system. The results show that pathological changes on the EEG during photostimulation were recorded in 1.73 percent of the subjects. A comparative evaluation of the results indicates that when conducting electroencephalography without photostimulation, 25 percent of the pathological cerebral reactions remain undetected. It is concluded that in the practice of military flight examinations the photostimulation method should be a mandatory technique for activating bioelectric activity in the brain. D.L.G.

N73-20112 Joint Publications Research Service, Arlington, Va.
EQUIVALENCE OF THE EFFECT OF CORIOLIS ACCELERATION ON RECEPTORS OF THE SEMICIRCULAR CANALS AT SOME ANGULAR ACCELERATION **c05**
I. Yu. Sarkisov and A. A. Shipov *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 126-129 refs (For availability see N73-20094 11-04)

A method is presented for determining angular acceleration in which movements of the cupulae in all six semicircular canals would be identical to those caused by exposure to coriolis accelerations. Differential equations of motion of the cupulae with allowance for external perturbing factors are given, and an example of determination of the angular acceleration equivalent to the stipulated coriolis acceleration is cited. D.L.G.

N73-20113 Joint Publications Research Service, Arlington, Va.
CHANGES IN VISUAL FUNCTIONS AFTER EXPOSURE TO WEAK VESTIBULAR IRRITATIONS
V. I. Kartsev *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 130-132 refs (For availability see N73-20094 11-04)

The functional state of the human visual analyzer was investigated after exposure to weak vestibular irritations not causing motion sickness symptoms. A total of 78 experiments, 29 of which served as the control, were conducted. After 20 minutes of adaptation by the subjects to darkness an adaptometer was used in determining visual acuity when there was twilight illumination. Upon completion of irritation of the vestibular apparatus, the state of visual functions was again evaluated. In the control investigations there was no vestibular stimulus. It was established that the rate of adaptation of central vision, after stimulation of the semicircular canals, increased by 13 to 20 percent in comparison with the control investigations. However, the rate of adaptation after stimulation of the otolithic apparatus did not differ reliably from the control studies, although there was an obvious tendency to decrease. D.L.G.

N73-20114 Joint Publications Research Service, Arlington, Va.
EFFECT OF PACKAGING AND SOME USE CONDITIONS FOR DRUGS IN PHARMACIES CARRYING EMERGENCY RESERVES
V. B. Zubavin and G. Z. Ostravskaya *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 133-136 refs (For availability see N73-20094 11-04)

An investigation was conducted to determine the possibility of using Soviet produced polyethylene film as packaging for drugs in tablet form, to compare this packaging with that already in use, and to ascertain the sensitivity of drugs to spacecraft environments. The investigation resulted from a need to overcome the deficiencies of the present packaging used for drugs carried as emergency reserves by pilots and cosmonauts. Experience with the present packaging, metal containers with screw-on covers, has shown that such packaging does not always safeguard the drugs from the unfavorable effect of mechanical factors such as vibration, shock, and overloads. Environmental tests with the polyethylene film packaging indicate no adverse effect on the drugs from the mechanical factors mentioned. D.L.G.

N73-20115 Joint Publications Research Service, Arlington, Va.
REVIEW: BIOMEDICAL PROBLEMS IN SPACE FLIGHTS. INDEX OF SOVIET AND FOREIGN LITERATURE
Ye. M. Yugenov *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 137-199 ref (For availability see N73-20094 11-04)

A bibliographic index of world literature on space biology and medicine is reviewed. The method of compilation, arrangement of information, and the scope of the material are discussed. D.L.G.

N73-20116*# Kanner (Leo) Associates, Redwood City, Calif.
METABOLISM OF DRUGS. 77: IN VITRO METABOLISM OF ANTIPYRINE
H. Shimeno and H. Yoshimura Washington NASA Apr. 1973 12 p refs Transl. into ENGLISH from Yakugaku Zasshi (Tokyo), v. 92, no. 11, 1972 p 1376-1379
(Contract NASw-2481)
(NASA-TT-F-14868) Avail: NTIS HC $3.00 CSCL 06O

In connection with previous in vivo work which stated that antipyrine was mainly metabolized to 4-hydroxyantipyrine and 3-hydroxymethyl-2-methyl-1-phenyl-3-pyrazolin-5 one (AN-CH2OH), the in vitro metabolism of this drug was investigated by use of 9000 x g supernatant fraction of rat liver. It was found that antipyrine was oxidized to 4-hydroxyantipyrine and AN-CH2OH by the 9000 x g supernatant of the liver. These metabolites were detected by means of thin-layer and gas chromatographies, and by ultraviolet absorption spectral analysis. Author

N73-20117*# Linguistic Systems, Inc., Cambridge, Mass.
THE CAROTENOIDS OF SOME BASIDIOMYCETES: A CHEMIOTAXIONOMIC SURVEY
J. L. Fiasson Washington NASA Apr. 1973 103 p refs Transl. into ENGLISH of "Les Carotenoides des Basidiomycetes: Survol Chimiotaxinomique", Lyon Univ. thesis, Jul. 1968 p 84
(Contract NASw-2482)
(NASA-TT-F-14858) Avail: NTIS HC $7.25 CSCL 06A

Carotenoid pigments were investigated in about fifty species of Basidiomycetes belonging to the most diverse groups. About 20 of them were shown to possess this type of pigment, and these were analyzed in as detailed a manner as possible. Of this number, 12 had not previously been analyzed and supplementary information is offered on six species already studied. In addition, a new molecule was isolated and characterized and a structural hypothesis with its justification is proposed. The general conclusions which may be applied to fungus carotenogenesis as a whole show initial pigmentation seems to include beta-carotene, lycopene, and perhaps torulene. Author

N73-20118*# Linguistic Systems, Inc., Cambridge, Mass.
ADENIN-NUCLEOTIDES NAD (PLUS) AND NADN IN SKELETAL MUSCLES DURING INTENSIVE WORK AND AT REST
N. R. Chagovets Washington NASA Apr. 1973 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 207, no. 3, 1972 p 739-741
(Contract NASw-2482)
(NASA-TT-F-14856) Avail: NTIS HC $3.00 CSCL 06S

The dynamics of the adenin-nucleotide NAD(+) and NAD content in skeletal muscles was studied in rats, during intensive activity and rest periods. It was found that after the cessation of work, the degree of regeneration of muscular NAD normalizes after 15 minutes of rest, while the ATP/ADP ratio in the muscles still shows some decrease 30 minutes after work. F.O.S.

N73-20119*# Kanner (Leo) Associates, Redwood City, Calif.
RESISTANCE OF ANIMALS IMMERSED IN WATER TO HIGH ACCELERATION
R. Margaria, T. Gualtierotti, and D. Spinelli Washington NASA Feb. 1973 8 p ref Transl. into ENGLISH from Atti Accad. Naz. Lincei, Classe Sci. Fis. Mat. Nat. (Rome), v. 22, no. 6, 1957 p 703-706
(Contract NASw-2481)
(NASA-TT-F-14828) Avail: NTIS HC $3.00 CSCL 06S

The nullification of the forces of acceleration by immersion in water were tested experimentally. Fish and frogs were subjected to acceleration in a centrifuge in a column of water of varying depth. Rats were placed in a steel tank and allowed to fall to the floor. Under the conditions of the experiment, fishes and frogs manifested permanent damage to the otolitic system as well as temporary damage such as ischemia and hyperemia. Rats, while not exhibiting otolitic changes, succumbed to hemorrhagic pulmonary lesions due to a difference in specific

weight between the lung tissue and the rest of the body. The height of the column of water above the animal is an important factor since resistance to acceleration diminishes as the depth of water increases. An animal immersed in water can withstand acceleration ten times greater than when it is in air. Author

N73-20120*# Linguistic Systems, Inc., Cambridge, Mass.
RADIATION STERILIZATION WITH A VAN DE GRAAFF ACCELERATOR
W. Jahn and M. Schinkmann Washington NASA Mar. 1973 10 p refs Transl. into ENGLISH from Atomwirtschaft (Duesseldorf), v. 17, Sep./Oct. 1972 p 527-529
(Contract NASw-2482)
(NASA-TT-F-14821) Avail: NTIS HC $3.00 CSCL 06M

Radiation sterilization of medical disposable articles is discussed as one of the few areas of application for current industrial use of an energetic electron and gamma radiation. The sterilization process occurs according to statistical laws. This results in certain aspects which must be taken into consideration during application of radiation sterilization. Several technical and economic aspects of the procedure are detailed for an electron beam sterilization installation. Author

N73-20121# Bureau of Sport Fisheries and Wildlife, Washington, D.C. Western Fish Disease Lab.
EFFECT OF SONIC BOOM ON FISH Final Report
Robert S. Rucker Feb. 1973 71 p refs
(Contract DOT-FA72WAI-238)
(FAA-RD-73-29) Avail: NTIS HC $5.75

A program was initiated to study the effect of sonic boom on fish and fish eggs during critical stages of development. During the development of fish eggs they reach a critical period where they become sensitive to vibration or disturbance. This program was designed to determine if the disturbances caused by sonic booms could have a detrimental effect during this period. It consisted of both field and laboratory tests conducted at several National Fish Hatcheries. Fish eggs from both trout and salmon were reared in the normal manner, except that when they were in their most critical phase of development they were exposed to sonic booms produced by military airplanes. Egg and fish fry mortalities from exposed groups of eggs were compared to those for control groups of eggs spawned at the same time. These comparisons indicated that the sonic boom exposure caused no increase in mortality. Author

N73-20122*# Linguistic Systems, Inc., Cambridge, Mass.
HUMAN ADAPTATION TO HYPOXIA AND TOLERANCE OF HIGH ENVIRONMENTAL TEMPERATURES
A. N. Azhayev Washington NASA Apr. 1973 10 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 54, no. 9, 1968 p 1073-1076
(Contract NASw-2482)
(NASA-TT-F-14860) Avail: NTIS HC $3.00 CSCL 06S

Regular exposure to hypoxic hypoxia combined with physical load conditions of altitude chamber has favored an increased endurance. An increased endurance of high temperatures by human subjects was achieved with varying levels of hypoxic hypoxia and physical loads, which is in accordance with the fundamentals of training elaborated for sport medicine. Author

N73-20123*# Linguistic Systems, Inc., Cambridge, Mass.
CHANGES IN THE RESISTANCE OF THE ORGANISM TO EXTREME EFFECTS DURING PROLONGED ACCLIMATIZATION TO HYPOXIA
N. A. Agadzhanyn Washington NASA Apr. 1973 14 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 54, no. 4, 1968 p 496-501
(Contract NASw-2482)
(NASA-TT-F-14861) Avail: NTIS HC $3.00 CSCL 06S

White rats and rabbits were studied at an altitude of 3200 m and in a simulated altitude of 12,000 m to determine the periods of acclimatization to hypoxia and the changes in the resistance of the organisms to extreme effects. The results showed that acclimatization up to 45 days leads to increased tolerance of the organism to the effects of acute hypoxia, to the combined effect of hypoxia and high temperature, and to the effects of acceleration. Increased tolerance to extreme temperatures was observed as early as the 15th day of the stay at high altitudes and its maximum value was achieved by the 30th day of acclimatization. The morphological changes in acclimatized animals at a simulated altitude of 12,000 m were expressed in abrupt hemodynamic disorders and a prevalent effect on the blood vessels of the brain. Author

N73-20124*# Scientific Translation Service, Santa Barbara, Calif.
CONTRIBUTION TO THE CHEMICAL TAXONOMY OF THE AGARICALES PIGMENTS OF BOLETUS AND CORTINARIA
M. Gabriel Washington NASA Apr. 1973 86 p refs Transl. into ENGLISH of "Contribution a la Chimiotaxinomie des Agaricales Pigments des Bolets et des Cortinaires" Lyon Univ. Ph.D. Thesis, 1965 72 p
(Contract NASw-2483)
(NASA-TT-F-14865) Avail: NTIS HC $6.50 CSCL 06B

The pigments of the Boletus and the Cortinaria are studied. Almost all of the Boletaceae, Gomphidiaceae and Paxillaceae in the French flora and a certain number of Cortinaria were used in the study. The chemical characteristics of the pigments are presented, and the systematic interests of these pigments are discussed. Author

N73-20125*# Scientific Translation Service, Santa Barbara, Calif.
SOLVENT EFFECT OF ESR SPECTRA OF NITROXIDE FREE RADICALS
J. A. Soriaruiz Washington NASA Apr. 1973 13 p refs Transl. into ENGLISH from An. Quim. (Spain), v. 68, 1972 p 1189-1194
(Contract NASw-2483)
(NASA-TT-F-14866) Avail: NTIS HC $3.00 CSCL 06A

The use of nitroxide free radicals as spin labels in biochemical systems is extended. The nitroxides have a high sensitivity to the local environment, and all parameters are solvent dependent. The variation of these parameters when the nitroxide is in solution with several polar and nonpolar solvents is studied. An effective radius of r approximately equal to 3 A is calculated for the nitroxide molecules. Author

N73-20126*# Exotech Systems, Inc., Falls Church, Va.
SCIENTIFIC AND TECHNICAL SERVICES IN THE DEVELOPMENT OF PLANETARY QUARANTINE MEASURES FOR AUTOMATED SPACECRAFT Final Report, 1 Apr. 1972 - 31 Mar. 1973
Mar. 1973 41 p refs
(Contract NASw-2372)
(NASA-CR-131291; TR73-F) Avail: NTIS HC $4.25 CSCL 06M

Primary goals of the Planetary Quarantine Program are defined and used to provide a basis for planning and source allocation toward the development of planetary quarantine measures for the following automated spacecrafts: Viking 1975, Pioneer F and G, and Mariner Venus-Mercury 1973. G.G.

N73-20127*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MICROBIOLOGICAL SURVEILLANCE OF FOOD HANDLING AT NASA-MSFC
F. J. Beyerle 23 Feb. 1973 38 p ref
(NASA-TM-X-64734) Avail: NTIS HC $4.00 CSCL 06I

A microbiological surveillance program of cafeterias and snack bars was conducted to supplement the inspections by NASA Medical Center personnel and to gather information for cafeteria management to pinpoint areas of possible contamination. The work conducted under the program from its inception in January, 1972, to its termination on September 15, 1972 is summarized. Ten food handling facilities were included in the surveillance at NASA-MSFC. Author

N73-20128*# Techtran Corp., Glen Burnie, Md.
PROBLEMS OF SPACE BIOLOGY. VOLUME 12: THE GRAVITY RECEPTOR: EVOLUTION OF THE STRUCTURAL, CYTOCHEMICAL, AND FUNCTIONAL ORGANIZATION
Ya. A. Vinnikov, O. G. Gazenko, L. K. Titova, A. A. Bronshteyn, T. P. Tsirulis, R. A. Pevzner, V. I. Govardovskiy, F. G. Gribakin, V. P. Ivanov, M. Z. Aronova et al Washington NASA Mar. 1973 600 p refs Transl. into ENGLISH of the book "Probl. Kosmich. Biol., Tom 12, Retseptor Gravitatsii. Evolyutsiya Strukt., Tsitokhim. i Funkts. Organizatsii" Leningrad, Nauka Press, 1971

(Contract NASw-2037)
(NASA-TT-F-720) Avail: NTIS HC $6.00 CSCL 06C

Data are presented which were obtained by cytochemical, cytophysiological, and electron-microscopic methods, and pertain to the evolution of structural, cytochemical and functional organization of gravity receptors in invertebrates (statocysts) and vertebrates (vestibular apparatus). The functional mechanism of the gravity receptor is considered on the cellular, subcellular and molecular levels. Author

N73-20129*# California Univ., Los Angeles. Space Biology Lab.
PHYSIOLOGY OF CHIMPANZEES IN ORBIT. PART 1: SCIENTIFIC REPORT Final Report, 8 Jul. 1968 - 28 Feb. 1971
Allen Firstenberg and James McNew 10 Apr. 1972 210 p
(Contract NSR-05-007-158)
(NASA-CR-131374; POCO-04-071-006-Pt-1) Avail: NTIS HC $12.50 CSCL 06C

Major achievements and accomplishments are reported for the Physiology of Chimpanzees in Orbit Program. Scientific studies relate to behavior and physiology, and engineering studies cover telemetry, behavioral training, systems tests, life support subsystems, and program plan. Author

N73-20130*# California Univ., Los Angeles. Space Biology Lab.
PHYSIOLOGY OF CHIMPANZEES IN ORBIT. PART 2: INTERFACE DOCUMENT Final Report, 8 Jul. 1968 - 28 Feb. 1971
Allen Firstenberg 10 Apr. 1972 244 p
(Contract NSR-05-007-158)
(NASA-CR-131397; POCO-04-071-006-Pt-2) Avail: NTIS HC $14.25 CSCL 06C

Interface requirements are presented for the design and development of an earth orbiting experiment to be known as POCO, Physiology of Chimpanzees in Orbit. The POCO experiment may be designed to operate within an orbiting space station (provided artificial gravity measures are not employed), a Saturn 4-B workshop, an Apollo command module or service module, a Saturn-1B spacecraft LM adapter, or aboard one of the presently conceived appendages connected by an umbilical to a space station. This document sets forth the experiment definition and requirements and describes the hardware under development to accomplish these objectives. Author

N73-20131# Monsanto Research Corp., Dayton, Ohio.
RESEARCH PROGRAM ON BERYLLIUM OXIDE ANALYSIS AND TOXICITY Final Technical Report, Jun. 1971 - Jun. 1972
William G. Scribner Wright-Patterson AFB, Ohio AMRL Sep. 1972 50 p refs
(Contract F33615-71-C-1794; AF Proj. 6302)
(AD-754936; MRC-DA-340; AMRL-TR-72-72) Avail: NTIS CSCL 06/20

The carcinogenic activity of BeO has been shown to be a function of the temperature to which the beryllium has been exposed. Examination of the toxicological properties of various rocket exhaust products indicate that some products resemble high-fired BeO in their lack of carcinogenic activity, while others contain considerable quantities of water soluble beryllium and vary in toxicity. In analyzing blood samples it is necessary to obtain the total Be concentration although as mentioned some forms are not as reactive as others. Thus the research involved devising reaction conditions for the conversion of low-fired BeO and high-fired BeO such that the reaction mixture was in a form suitable for the gas chromatographic measurement of beryllium. Also discussed is the applicability of the technique for the conversion of the oxides in blood and tissue matrices. GRA

N73-20132# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VESTIBULAR REACTIONS METHODS OF STUDY AND THE EFFECTS ON VARIOUS ENVIRONMENTAL FACTORS
Yu. G. Grigorev, Yu. V. Farber, and N. A. Volokhova 15 Sep. 1972 232 p refs Transl. into ENGLISH of the publ. "Vestibulyarnyye Reaktsii" Moscow, Meditsina, 1970 p 1-196
(AD-753511; FTD-MT-24-1913-71) Avail: NTIS CSCL 06/19

The monograph gives information on the quantitative characteristics and reactivity of the vestibular analyzer and describes the nature of the functional connection between the intensity of vestibular reactions and the values of various parameters of the adequate stimulus (force, duration) for the nonauditory portion of the labyrinth. A special section contains data on the nature of the organism's reactions, adaptation peculiarities and change in the sensitivity and reactivity of the vestibular analyzer during a prolonged (up to 15 days) periodically occurring effect of the Coriolis forces. Analyzed is the symptom complex of motion sickness occurring after a man spends a certain time in a rotating room. The essence of this study, in addition to the overall physiological value, lies in the prospect of creating artificial gravitation onboard spacecraft. Examined are materials on the effect of a series of other factors of environment and, primarily, the ionizing radiation on the vestibular analyzer. Author (GRA)

N73-20133# National Academy of Sciences-National Research Council, Washington, D.C.
VISUAL SEARCH: A SYMPOSIUM CONDUCTED AT THE SPRING MEETING, 1970
1973 156 p refs
(AD-754327) Avail: NTIS MF $0.95; HC National Academy of Sciences, 2101 Constitution Ave., N. W., Washington, D. C. $5.95 CSCL 06/16

Contents: Experiments in visual search; Visual aspects of air collision; Dynamic visual search patterns; Detection of peripheral stimuli under psychological and physiological stress; Studies of extrafoveal discrimination; Modulation transfer function area as a measure of image quality; Visual scanning behavior; Visual information storage. GRA

N73-20134# Dayton Univ. Research Inst., Ohio. Research Inst.
BONE STRENGTH AND IN-FLIGHT MECHANICAL STRESSES Annual Report
G. A. Graves, P. K. Bajpai, E. E. McCullum, H. G. Stein (Aerospace Med. Res. Lab.), and F. Noyes (Aerospace Med. Res. Lab.) 15 Jul. 1972 66 p refs
(Contract F44620-71-C-0083; AF Proj. 9777)
(AD-754982; AFOSR-73-0027TR; AR-1) Avail: NTIS CSCL 06/12

Twelve rhesus monkeys, in four groups of three each, were implanted with resorbable calcium aluminate ceramic femur sections. Each group contained a ceramic of different chemical composition and crystallographic structure. Four other rhesus monkeys underwent surgery for the removal and immediate replacement of a segment of their femur and were used as controls. One animal in each group was sacrificed after 60, 120, and 180 days. Radiographic observations and biochemical serum and urine analysis was performed throughout the implant periods. Scanning electron microscopy, reflected light microscopy, microradiography, histology, and electron-microprobe analysis were performed on ceramic-bone samples after sacrifice. These observations are compared with the microstructural analysis of the four different types of ceramics prior to implanting. A detailed comparison of the four different ceramics relative to one another and to the control samples is also given. It was concluded that: (a) The ceramics used possessed adequate mechanical strength for use as femur sections in rhesus monkeys for up to 180 days when used in combination with an intermedullary fixation device; (2) The chemical composition of the implant definitely affects the type of organic tissue that forms. Author (GRA)

N73-20135# School of Aerospace Medicine, Brooks AFB, Tex.
RETINAL EFFECTS OF MULTIPLE PULSE GALLIUM ARSENIDE LASER Final Report, 1971
Robert W. Ebbers Nov. 1972 17 p refs
(AD-753419; SAM-TR-72-25) Avail: NTIS CSCL 06/16

The eyes of 38 anesthetized rhesus monkeys were exposed to near-infrared laser radiation from a repetitive pulse gallium arsenide laser. Pulse repetition frequencies of 40 pps and 1,000 pps were utilized with a 20 nsec. pulse width at the wavelength of 905 nm. Lesions for threshold determination were placed in the temporal paramacular area and could be produced only by varying exposure duration with fixed energy output. Therefore, the resultant 50% probability of damage values (ED-50)

were expressed as total exposure duration rather than energy per pulse. The ED-50 value of 0.72 sec. for the 1,000 pps exposure is significantly lower than the 22.3 sec. for the 40 pps exposure and demonstrates a cumulative effect. Author (GRA)

N73-20136# National Academy of Sciences-National Research Council, Washington, D.C. Committee on Vision.
COLOR VISION: A SYMPOSIUM CONDUCTED AT THE SPRING MEETING, 1971
1973 129 p refs Conf. held at Washington, D. C., 1971
(Contract N00014-67-A-0244-0211)
(AD-754328; ISB-0-309-02105-7) Avail: NTIS; National Academy of Sciences, 2101 Constitution Ave., N. W., Washington, D. C. HC $4.95 CSCL 06/16

Contents: Color vision deficiencies; Comparison of color vision tests used by the armed forces; Color in visual signaling; Comparative photointerpretation from panchromatic, color, and ektachrome infrared photography; Color, pattern, and related visual influences in architecture; Color in architecture. GRA

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N73-20137* General Electric Co., Philadelphia, Pa.
AIR CONDITIONED SUIT Patent
George R. Carl, inventor (to NASA) Issued 30 Jan. 1973 6 p Filed 27 Oct. 1970 Supersedes N72-20106 (10 - 11, p 1433) Sponsored by NASA
(NASA-Case-LAR-10076-1; US-Patent-3,713,480; US-Patent-Appl-SN-84290; US-Patent-Class-165-46; US-Patent-Class-312-1; US-Patent-Class-62-259) Avail: US Patent Office CSCL 06K

An environmentally controlled suit is described consisting of an airtight outergarment attached by an airtight bellows to the wall of a sterile chamber, an undergarment providing for circulation of air near the skin of the wearer, and a circulation system comprised of air supply and distribution to the extremities of the undegarment and central collection and exhaust of air from the midsection of the undergarment. A workman wearing the undergarment and attached circulation system enters the outer garment through a tunnel in the chamber wall and the attached bellows to work in the chamber without any danger of spreading bacteria. Official Gazette of U.S. Patent Office

N73-20138*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
STUDY OF DESIGN AND CONTROL OF REMOTE MANIPULATORS. PART 2: VIBRATION CONSIDERATIONS IN MANIPULATOR DESIGN Final Report
Wayne J. Book 15 Feb. 1973 38 p ref
(Contract NAS8-28055)
(NASA-CR-124189; DSR-73784-2-Pt-2) Avail: NTIS HC $4.00 CSCL 05H

An investigation is reported involving a mathematical procedure using 4 x 4 transformation matrices for analyzing the vibrations of flexible manipulators. Previous studies with the procedure are summarized and the method is extended to include flexible joints as well as links, and to account for the effects of various power transmission schemes. A systematic study of the allocation of structural material and the placement of components such as motors and gearboxes was undertaken using the analytical tools developed. As one step in this direction the variables which relate the vibration parameters of the arm to the task and environment of the arm were isolated and nondimensionalized. The 4 x 4 transformation matrices were also used to develop analytical expressions for the terms of the complete 6 x 6 compliance matrix for the case of two flexible links joined by a rotating joint, flexible about its axis of rotation. Author

N73-20139*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
STUDY OF DESIGN AND CONTROL OF REMOTE MANIPULATORS. PART 4: EXPERIMENTS IN VIDEO CAMERA POSITIONING WITH REGARD TO REMOTE MANIPULATION Final Report
Jay Mackro 15 Feb. 1973 22 p
(Contract NAS8-28055)
(NASA-CR-124190; DSR-73784-2-Pt-4) Avail: NTIS HC $3.25 CSCL 05H

The results are presented of a study involving closed circuit television as the means of providing the necessary task-to-operator feedback for efficient performance of the remote manipulation system. Experiments were performed to determine the remote video configuration that will result in the best overall system. Two categories of tests were conducted which include: those which involved remote control position (rate) of just the video system, and those in which closed circuit TV was used along with manipulation of the objects themselves. Author

N73-20140# Civil Aeromedical Inst., Oklahoma City, Okla.
ATTRITION-RETENTION RATES OF AIR TRAFFIC CONTROL TRAINEES RECRUITED DURING 1960 - 1963 AND 1968 - 1970
Bart B. Cobb, John J. Mathews, and Peter L. Nelson Nov. 1972 32 p refs
(FAA-AM-72-33) Avail: NTIS HC $3.75

This study involved a total of 6,367 subjects in three ATCS options. Of these, 2,000 entered FAA Academy training during 1960 to 1963, before an ATC aptitude test battery became operational in the screening of most applicants. The remaining 4,367 subjects, the vast majority of whom were selected from among aptitude-screened applicants, entered the Academy's basic training courses during October 1968 through March 1970. Percentages reflecting Academy elimination rates for entrants of the earlier and later time periods, respectively were: 20.9 and 19.3 for terminal area traffic control (TATC) personnel, 32.0 and 17.9 for air route traffic control center (ARTCC) trainees, and 18.5 and 12.8 for the flight service station (FSS) option recent time period. it was determined that the post-Academy attrition rates for the TATC, ARTCC, and FSS entrants of 1960-1963 were 16.0, 22.8, and 18.1 percent, respectively (averaging 19.6), whereas corresponding rates for those recruited only 20 to 38 months prior to the follow-up date were 10.1, 20.3, and 5.9 (averaging 17.2 percent). Author

N73-20141*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REDUCED GRAVITY FECAL COLLECTOR SEAT AND URINAL Patent Application
Jeri Wexler Brown, inventor (to NASA) Filed 15 Mar. 1973 12 p
(NASA-Case-MFS-22102-1; US-Patent-Appl-SN-341621) Avail: NTIS HC $3.00 CSCL 06I

A waste collection system is described for use in reduced gravity. The seat has an opening centrally located, with a pair of opposed depressed valleys on opposite sides of the opening for accommodating the ischial tuberosities of a user. The seat has contoured surfaces for providing support of the user's body and includes a prominent ridge towards the rear, which provides forward-aft positioning cue to the user. A curved recess is provided adjacent to the forward portion of the seat for accommodating a tubular urinal having an enlarged open mouth. NASA

N73-20142*# Chemtric, Inc., Rosemont, Ill.
UPGRADING AND EXTENDED TESTING OF THE MSC INTEGRATED WATER AND WASTE MANAGEMENT HARDWARE Final Report
R. A. Bambenek, P. P. Nuccio, T. L. Hurley, and W. J. Jasionowski May 1972 260 p refs
(Contract NAS9-9191)
(NASA-CR-128878; CHEMTRIC-FR-3084) Avail: NTIS HC $15.00 CSCL 06I

The results are presented of upgrading and testing an integrated water and waste management system, which uses the compression distillation, reverse osmosis, adsorption filtration and ion-exchange processes to recover potable water from urine, flush water and used wash water. Also included is the development of techniques for extending the useful biological life of biological filters, activated carbon filters and ion-exchange resins to at least 30 days, and presterilizing ion-exchange resins so that sterile

water can be recovered from waste water. A wide variety of reverse osmosis materials, surfactants and germicides were experimentally evaluated to determine the best combination for a wash water subsystem. Full-scale module tests with real wash water demonstrated that surface fouling is a major problem.
Author

N73-20143*# Versar, Inc., Springfield, Va.
EVALUATION OF PROPOSED SKYLAB AND SSP SOAP PRODUCTS Final Report
Frank C. Whitmore, Robert L. Durfee, and Jack M. Spurlock 30 Jan. 1973 63 p ref
(Contract NAS9-12672)
(NASA-CR-128880) Avail: NTIS HC $5.25 CSCL 06I

Three personal hygiene cleansing agents and one laundry detergent (sodium dodecyl benzene sulfonate), which are all candidates for use on long-duration space missions, were evaluated in terms of dermatological effects on human subjects and effects on microbiological species. None of the four materials exhibited adverse dermatological effects from either skin patch tests of two weeks duration or a simulated Skylab personal hygiene regimen of up to four weeks duration. No significant alterations in skin microflora during the use regimen were found. None of the four materials were found to serve as microbiological support media for the species tested, but a species of air-borne mold was observed to grow rapidly in a neutralized aqueous solution. None of the candidate agents was found to be strongly biocidal.
Author

N73-20144*# Aerojet Medical and Biological Systems, El Monte, Calif.
DEVELOPMENT OF A LABORATORY PROTOTYPE WATER QUALITY MONITORING SYSTEM SUITABLE FOR USE IN ZERO GRAVITY
John E. Misselhorn, Samual Witz, and Walter H. Hartung Jan. 1973 207 p refs
(Contract NAS1-10382)
(NASA-CR-112267) Avail: NTIS HC $12.50 CSCL 06I

The development of a laboratory prototype water quality monitoring system for use in the evaluation of candidate water recovery systems and for study of techniques for measuring potability parameters is reported. Sensing techniques for monitoring of the most desirable parameters are reviewed in terms of their sensitivities and complexities, and their recommendations for sensing techniques are presented. Rationale for selection of those parameters to be monitored (pH, specific conductivity, Cr(+6), I2, total carbon, and bacteria) in a next generation water monitor is presented along with an estimate of flight system specifications. A master water monitor development schedule is included.
Author

N73-20145# Joint Publications Research Service, Arlington, Va.
CONSERVATION OF NATURAL RESOURCES AND WILD LIFE
9 Mar. 1973 28 p refs Transl. into ENGLISH from Priroda (Moscow), no. 1, 1973 p 78-87
(JPRS-58429) Avail: NTIS HC $3.50

Selected articles consider the conservation and rational use of natural resources through international protection measures to preserve the natural environment. Considered are the psychological aspects of the problem, man's effect on the natural landscape, improvements of natural resources by intelligent planning of scientific and technological developments, and farming of sea animals.
G.G.

N73-20146# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
VERY LOW ALTITUDE DETECTION OF SMALL STATIONARY TARGETS AT VERY SLOW SPEEDS: A SIMULATION STUDY USING STRIP PHOTOGRAPHY Final Report
Herschel C. Self Aug. 1972 41 p
(AF Proj. 7184)
(AD-754928; AMRL-TR-72-7) Avail: NTIS CSCL 05/10

The target-seeking behavior of observers was examined at four different image motion rates using strip photography film taken at a 497-foot altitude. Targets imaged at a scale of 1:274 on a 14 by 14-inch display screen showing a 320 by 320-foot ground area were garbage cans and manhole covers in a residential suburb. Film moved through the projector at 3, 6, 9, or 15 inches/minute representing conditions of either rapid (flash) reporting or screening, or else aerial search for small targets with a 2.2X stabilized periscope at very slow helicopter speeds. Thirty-eight subjects were dividied into four groups. Each group was tested at a different speed: 2.1, 4.2, 6.3, and 10.5 knots respectively. Conclusions are drawn about rapid film screening and about periscopic search for small targets at very slow speeds.
Author (GRA)

N73-20147# Perceptronics, Inc., Encino, Calif.
MAN/MACHINE INTERACTION IN ADAPTIVE COMPUTER AIDED CONTROL INITIAL STUDY
Amos Freedy, Randall Steeb, and Gershon Weltman 15 Nov. 1972 73 p refs
(Contract N00014-72-C-0093; NR Proj. 196-118)
(AD-754835; TR-72-10) Avail: NTIS CSCL 05/8

Maintenance of continuous decision and control actions places a severe load on the operators of many advanced Navy systems. Adaptive computer-aided control offers a promising means of improving overall system performance by relieving the operator of routine control tasks and allowing him to concentrate on his most effective roles as initiator, supervisor and emergency monitor. The present research program is directed toward developing human factors criteria for the application of adaptive computer aiding in a broad variety of complex man/machine systems. The report presents the initial year's progress. Included are: (1) a rationale for the adaptive aiding approach and a review of related research; (2) a description of the adaptive aiding computer program and the two-dimensional control task simulation developed for the pilot experimental study; (3) the experimental design, procedure, and measurement techniques along with a discussion of the results; and (4) the development of a preliminary mathematical model for the man/machine interaction in adaptive aiding.
Author (GRA)

N73-20148# Bunker-Ramo Corp., Westlake Village, Calif. Electronic Systems Div.
HUMAN ENGINEERING FOR THE AIR FORCE CONTROL DISPLAY PROGRAM Final Report, 25 Jun. 1969 - 24 Jun. 1972
Thomas A. Snyder and A. C. McTee Wright-Patterson AFB, Ohio AFFDL Jun. 1972 60 p refs
(Contract F33615-69-C-1716; AF Proj. 6190)
(AD-754916; SA-72-1; AFFDL-TR-72-109) Avail: NTIS CSCL 01/3

A research program which addresses each of two interface problems to be considered in the conduct of advanced control-display research within the system context, namely, the manager/information systems interface and the pilot/aircraft interface. Activities included an investigation to explore the potential of an on-line terminal with a CRT and printer. The Control-Display Information Program is directed toward developing a properly designed search and retrieval system utilizing the computer to its fullest potential, in addition to maintaining the day-to-day operation of satisfying the technical information requirements of control-display researchers.
Author (GRA)

N73-20149# Army Medical Research Lab., Fort Knox, Ky.
A VERSATILE, INEXPENSIVE GENERATOR OF PERIODIC VISUAL STIMULI Progress Report
James N. Cronholm and Isaac Behar 17 Nov. 1972 14 p refs
(DA Proj. 3A0-61102-B-71R)
(AD-754562; USAMRL-1010) Avail: NTIS CSCL 06/2

The report describes a light modulator which consists of two parts: (1) an aperture and rotating disc of varying radius and (2) an optical integrating bar with opal diffusers at each end. With the aperture (typically a slit) uniformly illuminated, the amount of light transmitted is determined by the area of the aperture which is unoccluded by the rotating opaque disc. The radius of the disc varies as the desired modulating function of time or angular position. Light from the aperture then passes through the optical integrating bar with its two opal diffusers. Together, these elements convert the fluctuations in size and location of the incident beam into periodic variations in luminous intensity over the whole area of the output opal diffusing surface.

This report also describes the implementation of several waveforms, including sinusoidal modulation of intensity and brightness, square, triangular, cogwheel, and spike waves, as well as a form of dynamic color mixing. Author (GRA)

N73-20150# Illinois Univ., Savoy. Aviation Research Lab.
ASSESSMENT OF PILOTAGE ERROR IN AIRBORNE AREA NAVIGATION PROCEDURES
Stanley N. Roscoe Oct. 1972 16 p refs
(Contract F44620-70-C-0105; AF Proj. 9778)
(AD-754214; ARL-72-24/AFOSR-72-13; AFOSR-72-2467TR) Avail: NTIS CSCL 05/5

In 1969, by specifically including pilotage error in the error budget for area navigation system certification, the Federal Aviation Administration legally attached economic premiums and penalties to human as well as equipment performance in man-machine system design. To establish the accuracy of use and freedom from pilot blunders associated with systems employing various configurations of displays and controls requires both simulator and flight experimentation. An automatically adaptive cockpit side task provides a saturing level of pilot workload and allows the sensitive, orderly, and statistically reliable measurement of a pilot's residual attention as a common metric for area navigation system assessment. Author (GRA)

N73-20151# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
LINK SYSTEM OF THE HUMAN TORSO Final Technical Report, Jun. 1970 - Jul. 1971
Richard G. Snyder, Don B. Chaffin, and Rodney K. Schutz Aug. 1972 317 p refs
(Contract F33615-70-C-1777; AF Proj. 7184)
(AD-754924; HSRI-71-112; AMRL-TR-71-88) Avail: NTIS CSCL 05/5

The objective of the study was to develop a quantitative description of the mobility of the human torso. This was accomplished by a systematic multi-disciplinary investigation involving techniques of cadaver dissection, anthropometry, radiography and cinefluoroscopy, photogrammetric, and computer analysis. Seventy-two anthropometric dimensions were obtained on 28 male volunteers, including bone lengths of the extremities and vertebral landmarks. These subjects were statistically matched for both stature and weight to a 1967 USAF anthropometric survey of 2385 adult males. Both radiographs and photographs from different viewing angles were then taken of the subjects while they performed specific reach motions. Statistical regressions were obtained which describe how specific surface markers and bone reference points move in relation to the elbow position for both seated and standing subjects. The major results of the study are, prediction equations and graphs for a large range of body positions and specific anthropometric variables; prediction equations and graphs describing how the base of the spine reference point moves in relation to defined seated and standing reference points for given reaches; a statistical tabulation with illustrations of 72 anthropometric dimensions. Author (GRA)

N73-20152# Stanford Univ., Calif. Dept. of Computer Science.
REPRESENTATION AND DESCRIPTION OF CURVED OBJECTS
Gerald Jacob Agin Oct. 1972 140 p refs
(Contract ARPA SD-183; ARPA Order-457)
(AD-755139; STAN-CS-72-305; AIM-173) Avail: NTIS CSCL 06/4

Three dimensional images, similar to depth maps, are obtained with a triangulation system using a television camera, and a deflectable laser beam diverged into a plane by a cylindrical lens. Complex objects are represented as structures joining parts called generalized cylinders. These primitives are formalized in a volume representation by an arbitrary cross section varying along a space curve axis. Several types of joint structures are discussed. Experimental results are shown for the description (building of internal computer models) of a handful of complex objects, beginning with laser range data from actual objects. Our programs have generated complete descriptions of rings, cones, and snake-like objects, all of which may be described by a single primitive. Complex objects, such as dolls, have been segmented into parts, most of which are well described by programs which implement generalized cylinder descriptions. Author (GRA)

N73-20153# Federal Aviation Administration, Washington, D.C. Office of Management Systems.
THE 1971 US CIVIL AIRMEN STATISTICS
Sep. 1972 42 p refs
(AD-754271) Avail: NTIS CSCL 05/9

The collection and dissemination of expanded aircraft data have created a need for more compatible airmen statistics. This information is required to establish more valid relationships between aircraft and airmen and to furnish more realistic bench marks for measuring trends in the civil airmen counts and their overall effect on the various segments of aviation. Statistics pertaining to airmen, both pilot and nonpilot, were obtained from the official airman certification records maintained by the Data Services Division, of the FAA Aeronautical Center, at Oklahoma City, Oklahoma, indicating active pilot and active nonpilot certificates held and airman certificates issued. Author (GRA)

N73-20154# Naval Medical Research Inst., Bethesda, Md.
A DIVER MONITORING SYSTEM FOR PHYSIOLOGIC STUDIES IN ALL HYPERBARIC ENVIRONMENTS Medical Research Progress Report No. 3
William E. Moritz 18 Oct. 1972 28 p refs
(M4306041023B)
(AD-754399) Avail: NTIS CSCL 06/2

A package of instrumentation has been assembled that can monitor the following parameters on divers; electrocardiogram, respiratory gas flow, core temperature, up to 8 skin or gas temperatures, environmental temperature and ambient pressure. The signal conditioners are carried on the diver in a stainless steel cylinder capable of operation at 1700 feet of sea water. The output of each signal conditioner is fed to a 15 channel multiplex data handling system for transmission to the surface monitoring station. All sensor inputs, power and the multiplex output are made through underwater connectors to increase the versatility of the system. The unit has been used extensively in wet and dry hyperbaric chambers as well as deep water tanks and the open sea. The data can be displayed on a strip chart recorder or analyzed on a computer based data analysis system. Author (GRA)

N73-20155# National Highway Traffic Safety Administration, Washington, D.C.
ANALYSIS OF DECELERATOR, ACCELERATOR AND SHOCK CORD PROPELLED REBOUND SLEDS FOR EVALUATING AIR BAG RESTRAINTS Final Report
Arnold K. Johnson Aug. 1972 33 p
(PB-212706; DOT-HS-820-220) Avail: NTIS HC $3.00 CSCL 14B

In contrast to a decelerator sled which comes to rest, thereby maintaining a constant velocity (zero) post impact, accelerator and shock cord propelled, impact-with-rebound sleds may decelerate immediately post-impact. The deceleration of the accelerator sled post-impact is due to frictional forces, and that of the shock cord propelled, rebound sled is due to frictional forces plus forces exerted on the sled by the shock cord. The analysis of the effect of deceleration immediately post-impact for a subject restrained only by an air bag establishes that the distance the subject translates forward in the seat is less, and that his rebound velocity against the seat is greater, than if he had been riding a decelerator sled for the same impact conditions. Author (GRA)

N73-20156*# Chicago Univ., Ill.
HIERARCHICAL HYBRID CONTROL OF MANIPULATORS: ARTIFICIAL INTELLIGENCE IN LARGE SCALE INTEGRATED CIRCUITS Final Report
Peter H. Greene 31 Aug. 1972 38 p refs
(Grant NGR-14-001-199; Contract N00014-67-A-0285-0012)
(NASA-CR-131403; AD-754676) Avail: NTIS HC $4.00 CSCL 06/4

Both in practical engineering and in control of muscular systems, low level subsystems automatically provide crude approximations to the proper response. Through low level tuning of these approximations, the proper response variant can emerge from standardized high level commands. Such systems are

expressly suited to emerging large scale integrated circuit technology. A computer, using symbolic descriptions of subsystem responses, can select and shape responses of low level digital or analog microcircuits. A mathematical theory that reveals significant informational units in this style of control and software for realizing such information structures are formulated. GRA

N73-20157# Kansas State Univ., Manhattan. Inst. for Environmental Research.
PERFORMANCE AND LIFE SUPPORT IN ALTERED ENVIRONMENTS Final Report, 15 Sep. 1967 - 31 Aug. 1972
J. E. Kipp and Ralph G. Nevins 31 Oct. 1972 51 p refs
(Contract F44620-68-C-0020)
(AD-754216; AFOSR-72-2464TR) Avail: NTIS CSCL 06/11

Multidisciplinary studies of performance and life support in altered environments have been carried out. A summary of these investigations, including goals, personnel, and bibliographical data, is provided. Final phase progress reports as well as an over view of the results of this study when viewed as a single integrated study are also included. Author (GRA)

N73-20109 Joint Publications Research Service, Arlington, Va.
ROLE OF SOCIAL SYNCHRONIZERS IN ADAPTATION TO UNUSUAL DAILY SCHEDULES
S. I. Stepanova *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 102-111 refs (For availability see N73-20094 11-04)

N73-20112 Joint Publications Research Service, Arlington, Va.
EQUIVALENCE OF THE EFFECT OF CORIOLIS ACCELERATION ON RECEPTORS OF THE SEMICIRCULAR CANALS AT SOME ANGULAR ACCELERATION
I. Yu. Sarkisov and A. A. Shipov *In its* Space Biol. and Med., No. 1, 1973 2 Apr. 1973 p 126-129 refs (For availability see N73-20094 11-04)

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N73-20158 National Lending Library for Science and Technology, Boston Spa (England).
GAS CHROMATOGRAPHY OF SOME METAL CHELATES OF 3-ALKYL ACETYL ACETONES
Akira Kito, Yoshizo Miyake, Hiroshi Kobayashi, and Keihei Ueno [1972] 11 p refs Transl. into ENGLISH from Jap. Anal. (Japan), v. 20, 1971 p 1363-1369
(NLL-M-22879-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Beryllium (II), aluminium (III), copper (II) and chromium (III) of tertiary alkyl acetylacetones were synthesized and their subliming ability, thermogravimetric analysis and gas chromatic behavior were examined. Beryllium (II) and chromium (III) chelates are sufficiently thermally stable for the purpose of gas chromatographic analysis, but their volatility is generally lower than metal chelates of acetylacetone in general. Aluminium (III) chelates showed virtually no degradation in thermogravimetric analyses, but appear to have produced partial decay, judging by the results of gas chromatographic experiments. Copper (II) chelates are low in thermal stability, therefore such metal chelates cannot be used for gas chromatographic analysis. It was found from examining Al(3Meaa)3 in various types of stationary phase liquids that Micro wax has the highest separating efficiency for its metal chelates. The gas chromatographic separation of beryllium (II), aluminium (III) and chromium (III) chelates was excellent.
Author

N73-20159*# Vermont Univ., Burlington. Dept. of Chemistry.
CONDENSATION CYCLIZATION REACTIONS OF ELECTRON DEFICIENT AROMATICS. 4: TRICYCLIC NITROPROPENE NITRONATES FROM THE REACTION OF PHLOROGLUCINOL AND CYCLOALKANONES WITH SYM-TRINITROBENZENE
Michael J. Strauss, Stephan P. B. Taylor, and H. Shindo (JEOL, Inc.) [1972] 17 p refs Sponsored in part by AROD
(Grant NGL-46-001-008)
(NASA-CR-131288) Avail: NTIS HC $3.00 CSCL 07D

Interesting similarities have been shown between the reactions of sym-trinitrobenzene with cycloalkanones, and with phloroglucinol. Previously unsuspected common intermediates have been shown to intervene. The structurally similar products in each case are tricyclic nitropropene nitronates. Protonation of these yields the corresponding nitronic acids in certain instances.
Author

N73-20160# Defence Research Establishment Valcartier (Quebec).
PRODUCTION OF VIBRATIONALLY EXCITED CARBON MONOXIDE BY THE REACTION OF OXYGEN ATOMS WITH ACETYLENE, METHYLACETYLENE AND METHANE
S. J. Arnold and G. H. Kimbell Dec. 1972 13 p refs
(DREV Proj. 95-10-68)
(DREV-TN-2051/72) Avail: NTIS HC $3.00

Infrared chemiluminescence attributed to the first overtone of CO was observed when either C2H2 or CH3C2H was introduced into a stream of oxygen which was passed through a microwave discharge. The addition of vibrationally cold CO to these systems was found to produce a vibrational population inversion in the chemically formed CO. CO first overtone emission was not observed when CH4 was introduced into a similar stream of oxygen unless the CH4 was already partially dissociated by a microwave discharge. These observations are used to clarify the mechanisms governing the formation of CO in continuous wave air-helium-hydrocarbon electrical discharge lasers. Author

N73-20161*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A NEW TECHNIQUE FOR AUGER ANALYSIS OF SURFACE SPECIES SUBJECT TO ELECTRON-INDUCED DESORPTION
Stephen V. Pepper Washington Apr. 1973 14 p refs
(NASA-TN-D-7257; E-7206) Avail: NTIS HC $3.00 CSCL 07D

A method is presented to observe surface species subject to electron-induced desorption by Auger electron spectroscopy. The surface to be examined is moved under the electron beam at constant velocity, establishing a time independent condition and eliminating the time response of the electron spectrometer as a limiting factor. The dependence of the Auger signal on the surface velocity, incident electron current, beam diameter, and desorption cross section are analyzed. The method is illustrated by the Auger analysis of PTFE, in which the fluorine is removed by electron induced desorption. Author

N73-20162*# Pittsburgh Univ., Pa. Dept. of Chemistry.
GAS PHASE RECOMBINATION OF HYDROGEN AND DEUTERIUM ATOMS Ph.D. Thesis
Daniel W. Trainor, David O. Ham, and Frederick Kaufman Mar. 1973 42 p refs
(Grants NGR-39-011-002; NSF GP-10327)
(NASA-CR-131417; SRCC-186) Avail: NTIS HC $4.25 CSCL 07D

Rate constants for the reaction H + H + M - H2 + M, with M = H2, He, and Ar were measured over the temperature range 77 to 298 K. Hydrogen atoms were produced by thermal dissociation and absolute atom concentrations were measured through use of self-balancing, isothermal catalytic probe detector. The specific rate constants were 8.1 + or - 0.4 x 10 to the minus 33rd power, 7.0 + or - 0.4 x 10 to the minus 33rd power, and 9.2 + or - 0.6 x at 298 K for M = H2, He, and Ar respectively; these values rising to 18.5 + or - 2.2 x 10 to the minus 33rd power, 12.0 + or - 1.5 x 10 to the minus 33rd power, and 27.4 + or - 4.6 x 10 to the minus 33rd power cm to the 6th power/molecules sq/sec at 77 K. for the equivalent deuterium atom process with D2 as the third body, the rate constants are 6.1 + or - 0.3 x 10 to the minus 33rd power cm to the 6th power/molecules sq/sec at 298 K and 15.1 + or - 1.0 x 10 to the minus 33rd power cm to the 6th power/molecules sq/sec at 77 K. These values are compared with previous experimental measurements and with recent theoretical calculations. Author

N73-20163# Technology, Inc., Dayton, Ohio.
BOUND-BOUND TRANSITION PROBABILITIES OF ARGON 1 Final Report, 25 Feb. - 4 Apr. 1972
Paul N. Arendt Wright-Patterson AFB, Ohio ARL Aug. 1972 130 p refs
(Contract F33615-71-C-1463; AF Proj. 7063)
(AD-754025; ARL-TR-72-0116) Avail: NTIS CSCL 07/4

Transition moments and their associated transition probabilities, line strengths and absorption oscillator strengths have been computed for neutral argon. The lower and upper energy levels of the transitions tabulated herein include, respectively, the excited levels of the three lower principle quantum numbers and levels up to a principle quantum number of 16. Author (GRA)

N73-20164# Technology, Inc., Dayton, Ohio.
FREE-BOUND AND BOUND-BOUND PRESSURE DEPENDENT ABSORPTION COEFFICIENTS OF ARGON Final Report, 6 Jul. 1971 - 5 Jul. 1972
Paul N. Arendt Wright-Patterson AFB, Ohio ARL Aug. 1972 38 p refs
(Contract F33615-71-C-1463; AF Proj. 7063)
(AD-754007; ARL-TR-72-0115) Avail: NTIS CSCL 07/4

Free-bound relative continuum-absorption cross sections are presented for the first ninety excited s, p, and d states of neutral argon. Wavelength, pressure and temperature dependent Xi factors are derived for free-bound transitions using the above factors and hydrogenic cross sections for all the other excited states. Weak bound-bound transitions are also included in this analysis. A wavelength dependent Xi factor is also derived for these transitions. Comparisons of the above Xi factors are made with experimental measurements. Author (GRA)

N73-20165# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMODYNAMIC AND THERMOPHYSICAL PROPERTIES OF COMBUSTION PRODUCTS. METHODS OF CALCULATION
V. E. Alemasov and A. F. Dregalin 29 Sep. 1972 645 p refs Transl. into ENGLISH of "Termodinamicheskie i Teplofizicheskiye Svoystva Produktov Sgopaniya. Metody Raschera, Vol. 1" USSR 1971 p 1-266
(AD-754329; FTD-MT-24-1223-72) Avail: NTIS CSCL 07/4

The handbook contains information about the combustion products of high-energy propellants. Two- and three-component propellant compositions are examined. Among the active oxidizers, oxygen and fluorine, mixtures of them, and also compounds rich in oxygen and fluorine are examined. Among the high-energy fuels a preferential place is occupied by compounds rich in hydrogen, and also metalliferous fuels. Information is also given about the combustion products of some fuels with air and the decomposition products of some compounds used as monopropellants. Primarily the report discusses the thermodynamics used in understanding the combustion and combustion products. GRA

N73-20166# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
QUESTIONS CONCERNING POSSIBLE DETERMINATION OF STRUCTURE PARAMETERS OF THE VIBRATIONAL-ROTATIONAL SPECTRA OF H2O BY MEANS OF THE MINIMIZATION TECHNIQUE
A. G. Pokorovskii and M. Ya. Rozinskii 27 Dec. 1972 18 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., Ser. Fiz. i Khim. (Leningrad), v. 25, no. 22, 1970 p 22-29
(AD-754612; FTD-MT-24-1074-72) Avail: NTIS CSCL 07/4

Experimental and theoretical equations describing structural parameters of the IR spectra of H2O are presented. Several of these have been well established by various methods. The values of these are assumed. Errors are observed in calculations of the oscillator strengths and the halfwidths of the lines. The true value of these parameters and the difference between experimental and calculated curves were obtained. GRA

N73-20167# Watervliet Arsenal, N.Y.
ADSORPTION OF NICKEL IONS ON ALUMINA AND TITANIA FROM AQUEOUS SOLUTIONS
G. R. Lakshminarayanan, Edward S. Chen, and Fritz K. Sautter Sep. 1972 26 p refs
(DA Proj. 1T0-61101-A-91A)
(AD-754540; WVT-7245) Avail: NTIS CSCL 07/4

The adsorption of nickel ions at the Al2O3-nickel electrolyte and TiO2-nickel electrolyte interface was studied as a function of pH, particle size and crystalline form. The results show that nickel ions exhibit marked adsorption on these oxides and that the solution pH as well as the presence of divalent anions are important parameters affecting the adsorption. The slow dissolution of oxide with time in electrolyte-oxide suspensions is a significant factor to be minimized in the plating process of dispersion-hardened alloys. Author (GRA)

N73-20168# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THERMODYNAMIC PROPERTIES OF Ir2S3 AND IrS2 Report for Jan. 1969 - Nov. 1970
Elfreda T. Chang and Nev A. Gokcen 15 Sep. 1972 20 p refs
(Contract F04701-72-C-0073)
(AD-753897; TR-0073(3240-20)-1; SAMSO-TR-72-274) Avail: NTIS CSCL 07/4

Thermodynamic properties of Ir2S3 have been obtained from the equilibrium pressures of S2(g) measured by the effusion technique in the range of 920 to 1110 K. The standard Gibbs energy change at these temperatures for 2Ir(s) + 1.5 S2(g) = Ir2S3(s) is found to be -91, 740 + 63.235 T cal/mole of Ir2S3 where T is the temperature in degrees Kelvin. The standard heat of formation of Ir2S3 extrapolated to 25 C is 298.15 = 49.34 kcal/mole. Similar data have been obtained for Ir2S3 + 0.5 S2(g) = 2 IrS2, from which the standard heat of formation of IrS2 is 298.15 = -31.36 kcal/mole. Author (GRA)

N73-20169# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EQUATION OF THE STATE OF A HELIUM AND NITROGEN MIXTURE
V. N. Popov and V. I. Chernyshov 27 Oct. 1972 14 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. Transp. (USSR), no. 3, 1971 p 162-165
(AF Proj. 7343)
(AD-753964; FTD-HT-23-956-72) Avail: NTIS CSCL 07/4

The equation of state describing the experimental data within the temperature range of 273.15 to 773.15K and a pressure up to 400 bars was obtained with respect to the compressibility of helium, nitrogen, and mixtures of them. Comparison of the calculated values of the coefficients of compressibility and density of the mixture of helium with nitrogen calculated by the proposed equation of state with the experimental values demonstrates satisfactory comparison in the entire temperature and pressure range encompassed by the experiment. Author (GRA)

N73-20170# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYNTHETIC ZEOLITES (SELECTED ARTICLES)
M. M. Dubinin 31 Oct. 1972 427 p refs Transl. into ENGLISH of Sintetich. Tseolity, Poluchenie, Issled. i Primenemie, Akad. Nauk SSSR, Otd. Khim. Nauk (Moscow), no. 1, 1962 p 1-286
(AD-754324; FTD-HC-23-729-72) Avail: NTIS CSCL 07/4

The report contains the articles, read at the first congress on zeolites, which took place in Leningrad on the 16th through 19th of May 1961 in the Lensovet Leningrad Technological Institute. Problems of the theory of adsorption on zeolites, methods of investigation, synthesis of various types of zeolites and their application are examined in these articles. Despite the fact that these reports basically give the results of original studies, the material in the volume is a sufficiently complete concept of the problem as a whole. Author (GRA)

N73-20171# Physics International Co., San Leandro, Calif.
MIXED PHASE EFFECTS IN ALUMINUM Final Report, 15 Apr. 1970 - 31 Oct. 1972
Vernon L. Bailey and Andrew Lutze Jan. 1973 188 p refs
(Contract DASA01-70-C-0114; DNA Proj. NWER-C321)
(AD-754449; PIFR-246; DNA-2992F) Avail: NTIS CSCL 07/4

A combined experimental and theoretical investigation of the radiation-induced impulse and stress generation characteristics of aluminum has been carried out for cases where a significant

portion of the blowoff material was in the liquid-vapor state. Intense pulsed electron beams were used as a source of rapid (50 nsec) high-energy-density loading to produce mixed-phase effects in aluminum. Impulse measurements were obtained with a ballistic pendulum for peak doses of up to 3800 cal/gm. Manganin gauges and the laser interferometer were used to obtain stress time records adjacent to the region of energy deposition. Author (GRA)

N73-20172# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF A MAGNETIC FIELD ON THE DEVELOPMENT PROCESS OF CRYSTALLIZATION CENTERS OF HYDRATED GLUCOSE
E. Ya. Zharova 5 Jan. 1973 19 p refs Transl. into ENGLISH from Tr. Vses. Nauchn.-Issled. Inst. Krarmaloprod. (Moscow), no. 8, 1966 p 34-40
(AD-754618; FTD-MT-24-1644-72) Avail: NTIS CSCL 07/4

The work deals with the effect of a magnetic field on the kinetics of phase transformation processes and discusses difficulties encountered therein. Crystallization of hydrated glucose is used to study these processes, due to the fact that hydrated glucose has the ability to form crystals of various systems and crystals with diversified dimensions and external form in the same system. Discussed are factors which affect the crystallization rate and parameters which can predict the kinetics of crystallization and affect the dimensions and form of the crystals.
Author (GRA)

N73-20173# Naval Research Lab., Washington, D.C.
DEVELOPMENT OF X-RAY FLUORESCENCE SPECTROSCOPY FOR ELEMENTAL ANALYSIS OF PARTICULATE MATTER IN THE ATMOSPHERE AND IN SOURCE EMISSIONS
L. S. Birks, J. V. Gilfrich, and P. G. Burkhalter Oct. 1972 48 p refs Sponsored by EPA
(PB-213366; EPA-R2-72-063) Avail: NTIS HC $3.00 CSCL 07D

The application of X-ray fluorescence to the analysis of air pollution particulate samples was demonstrated to be a rapid and economical technique at concentrations encountered in practical situations. No sample preparation is necessary for particulates deposited on filters, which can be placed directly in the X-ray equipment. All of the elements of interest can be measured simultaneously in 100 seconds with either multichannel X-ray crystal spectrometers or multichannel analyzers with energy dispersion detectors. Sensitivity and detectability were compared for four types of excitation and for the two types of data acquisition. Author (GRA)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N73-20174* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DOPPLER COMPENSATION BY SHIFTING TRANSMITTED OBJECT FREQUENCY WITHIN LIMITS Patent
Charles R. Laughlin, Roger C. Hollenbaugh, and Walter K. Allen, inventors (to NASA) Issued 6 Feb. 1973 6 p Filed 18 Jun. 1970 Supersedes N70-41978 (08 - 24, p 4467) Continuation-in-part of US Patent Appl. SN-701679, filed 30 Jan. 1968
(NASA-Case-GSC-10087-4; US-Patent-3,715,663; US-Patent-Appl-SN-47440; US-Patent-Class-325-4; US-Patent-Class-325-5; US-Patent-Class-325-7; US-Patent-Class-325-8; US-Patent-Class-325-9; US-Patent-Class-325-12; US-Patent-Class-325-17; US-Patent-Class-325-63; US-Patent-Class-343-179; US-Patent-Appl-Sn-701679) Avail: US Patent Office CSCL 17B

A system and method are disclosed for position locating, deriving centralized air traffic control data, and communicating via voice and digital signals between a multiplicity of remote aircraft, including supersonic transports, and a central station. Such communication takes place through a synchronous satellite relay station. Side tone ranging patterns, as well as the digital and voice signals, are modulated on a carrier transmitted from the central station and received on all of the supersonic transports. Each aircraft communicates with the ground stations via a different frequency multiplexed spectrum. Supersonic transport position is derived from a computer at the central station and supplied to a local air traffic controller. Position is determined in response to variable phase information imposed on the side tones at the aircraft. Common to all of the side tone techniques is Doppler compensation for the supersonic transport velocity.
Official Gazette of the U.S. Patent Office

N73-20175* National Oceanic and Atmospheric Administration, Boulder, Colo.
DETERMINING DISTANCE TO LIGHTNING STROKES FROM A SINGLE STATION Patent
Lothar H. Ruhnke, inventor (to NASA) Issued 6 Feb. 1973 5 p Filed 30 Dec. 1971 Supersedes N72-21159 (10 - 12, p 1574) Sponsored by NASA
(NASA-Case-KSC-10698; US-Patent-3,715,660; US-Patent-Appl-SN-213949; US-Patent-Class-324-72; US-Patent-Class-73-170R) Avail: US Patent Office CSCL 17B

Apparatus is described for determining the distance to lightning strokes from a single station. The apparatus includes a first loop antenna system for sensing the magnetic field produced by the lightning which is filtered, square rooted, and fed into a peak voltage holding circuit. A second antenna is provided for sensing the electric field produced by the lightning which is fed into a filter, an absolute value meter, and to a peak voltage holding circuit. A multivibrator gates the magnetic and electric signals through the peak holding circuits to a ratio meter which produces a signal corresponding to the ratio between the magnetic component and the electric component. The amplitude of this signal is proportional to the distance from the apparatus to the lightning stroke. Official Gazette of the U.S. Patent Office

N73-20176* Sperry Rand Corp., Huntsville, Ala.
FREQUENCY DIVISION MULTIPLEX TECHNIQUE Patent
Hans Brey, inventor (to NASA) Issued 6 Feb. 1973 16 p Filed 28 Dec. 1971 Supersedes N72-21160 (10 - 12, p 1574) Sponsored by NASA
(NASA-Case-KSC-10521; US-Patent-3,715,723; US-Patent-Appl-SN-212921; US-Patent-Class-340-146.1C; US-Patent-Class-340-147R; US-Patent-Class-340-163) Avail: US Patent Office CSCL 17B

A system for monitoring a plurality of condition responsive devices is described. It consists of a master control station and a remote station. The master control station is capable of transmitting command signals which includes a parity signal to a remote station which transmits the signals back to the command station so that such can be compared with the original signals in order to determine if there are any transmission errors. The system utilizes frequency sources which are 1.21 multiples of each other so that no linear combination of any harmonics will interfere with another frequency.
Official Gazette of the U.S. Patent Office

N73-20177 National Lending Library for Science and Technology, Boston Spa (England).
CODING AND MODULATION OF DIGITAL DATA IN RADIO TRANSMISSION
D. Lombard 10 Nov. 1972 22 p refs Transl. into ENGLISH from L'Onde Elec. (Paris), v. 51, no 8, Sep. 1971 p 714-723
(NLL-PO-2832-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The words coding and modulation are defined in the context of digital transmission, and details are given of the spectral densities obtained in the case of the simplest form of binary signal coding. Digital modulation processes are then examined, particularly that of phase shift. Details are given of the properties, and basic layouts of two-, four-, eight-, and sixteen-state, coherent and differential phase modulators. Author

N73-20178*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
AN EXPERIMENTAL INVESTIGATION OF THE POWER SPECTRUM OF PHASE MODULATION INDUCED ON A SATELLITE RADIO SIGNAL BY THE IONOSPHERE
David T. Moser 12 Dec. 1972 63 p refs
(Grant NGR-39-009-002; NSF GA-12228)
(NASA-CR-131280; PSU-IRL-SCI-405) Avail: NTIS HC $5.25 CSCL 17B

The power spectrum of phase modulation imposed upon satellite radio signals by the inhomogeneous F-region of the ionosphere (100 - 500 km) was studied. Tapes of the S-66 Beacon B Satellite recorded during the period 1964 - 1966 were processed to yield or record the frequency of modulation induced on the signals by ionospheric dispersion. This modulation is produced from the sweeping across the receiving station as the satellite transits of the two dimensional spatial phase pattern are produced on the ground. From this a power spectrum of structure sizes comprising the diffracting mechanism was determined using digital techniques. Fresnel oscillations were observed and analyzed along with some comments on the statistical stationarity of the shape of the power spectrum observed. Author

N73-20179# Research Inst. of National Defence, Stockholm (Sweden).
TERRAIN EFFECTS ON BROADBAND ANTENNA RADIATION PATTERNS AT FREQUENCY REGION OF 33 TO 75 MHz [TERRAENGENS INVERKAN PA BREDBANDSANTENNERS STRALNINGSDIAGRAM I FREKVENSOMRADET 33 - 75 MHZ]
Lennart Nilsson Apr. 1971 21 p ref In SWEDISH
(FOA-3-A-3747-60) Avail: NTIS HC $3.25

Uneven terrain effects on the radiation patterns of circular and directional antennas are considered. Results of optical measurements show that radiation patterns of both antenna types are affected by surrounding vegetation and that distortion effects increase with increased frequencies. Transl. by G.G.

N73-20180*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DECISION FEEDBACK LOOP FOR TRACKING A PHASE MODULATED CARRIER Patent Application
Marvin K. Simon, inventor (to NASA) Filed 6 Mar. 1973 30 p Sponsored by NASA
(NASA-Case-NPO-13103-1; US-Patent-Appl-SN-338484) Avail: NTIS HC $3.50 CSCL 17B

An N-phase modulated carrier tracking loop is disclosed in which carrier tracking efficiency is improved by making use of the decisions made on the data phase symbols theta sub K = (k+1) pi/N transmitted in each T-second interval. In particular, the decision, is used to produce a pair of decision-feedback quadrature signals which enhance the loop's performance in developing a loop phase error signal. NASA

N73-20181*# ITT Defense Communications Div., Nutley, N.J.
SPACECRAFT COMMUNICATIONS TERMINAL BREADBOARD COMPONENTS Final Report
Feb. 1973 81 p refs
(Contract NAS9-12984)
(NASA-CR-128859) Avail: NTIS HC $6.25 CSCL 17B

The C-band translator, transmitter, and attenuator are described for the spacecraft communication terminal breadboard components. The block diagram is also included for the C-band receiver. The system performance data and the mechanical properties of the system are briefly considered. J.A.M.

N73-20182# National Aviation Facilities Experimental Center, Atlantic City, N.J.
EVALUATE IMPROVED AIRPORT BEACON Final Report, Jan. 1970 - Nov. 1972
R. Johnston Mar. 1973 25 p
(FAA Proj. 071-312-02X)
(FAA-NA-73-1; FAA-RD-73-25) Avail: NTIS HC $3.25

Two forms of experimental beacons, strobe and incandescent, were tested to determine their suitability as improved replacement for the standard 36-inch rotating airport beacon presently in use. Neither unit demonstrated a clearcut superiority over the standard beacon, and the need for further development effort was indicated. A type of low-cost incandescent airport beacon was evaluated at the same time and found suitable for use at smaller, secondary airports. Author

N73-20183# Lincoln Lab., Mass. Inst. of Tech., Lexington.
CONCEPTS FOR IMPROVEMENT OF AIRPORT SURVEILLANCE RADARS
C. Muehe, J. Cremin, M. Labitt, M. Labitt, V. Sferrino, B. Gold, Hofstetter E., and D. Pruslin 26 Feb. 1973 58 p refs
(Contracts DOT-FA72WAI-242; F19628-73-C-0002)
(ATC-14) Avail: NTIS HC $5.00

The performance of operational airport surveillance radars is discussed. The subjects covered are: (1) the types of clutter which affect operation, (2) methods for overcoming clutter, and state-of-the art techniques incorporated into the radar system. Two radars, one at S-band and one at UHF, are analyzed to show compliance with requirements for air route traffic surveillance. It is concluded that the major improvements in performance will be derived from the use of linear optimum signal processing. Author

N73-20184# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DEVELOPMENT OF A DISCRETE ADDRESS BEACON SYSTEM Quarterly Technical Summary Report, 1 Oct. - 31 Dec. 1972
1 Jan. 1973 110 p refs
(Contracts DOT-FA72WAI-261; F19628-70-C-0230; Proj. 034-241-012)
(FAA-RD-73-12; QTSR-4) Avail: NTIS HC $7.50

The development of a discrete address beacon system (DABS) for air traffic control applications is discussed. The subjects presented are: (1) DABS link design modulation, (2) transponder design and cost studies, (3) transponder antenna/airframe pattern measurements, (4) sensor monopulse antenna-processor studies, and (5) rotating antenna traffic capability. DABS prototype field tests are recommended. A description of the DABS experimental facility hardware, software, and implementation status is included. Author

N73-20185*# Magnavox Co., Silver Spring, Md. Government and Industrial Div.
A CHANNEL SIMULATOR DESIGN STUDY Final Report, Jun. - Dec. 1970
D. M. DeVito, M. M. Goutmann, and R. C. Harper Jan. 1971 143 p
(Contract NAS5-20110)
(NASA-CR-130173; ASAO-PR20022-6) Avail: NTIS HC $9.25 CSCL 17B

A propagation path simulator was designed for the channel between a Tracking and Data Relay Satellite in geostationary orbit and a user spacecraft orbiting the earth at an altitude between 200 and 4000 kilometers. The simulator is required to duplicate the time varying parameters of the propagation channel. Author

N73-20186*# SCI Systems, Inc., Houston, Tex.
EIGHT CHANNEL TELEPHONE TELEMETRY SYSTEM Final Report
Ross E. Smith 8 Feb. 1973 50 p
(Contract NAS9-12947)
(NASA-CR-128877) Avail: NTIS HC $4.50 CSCL 17B

A portable, indirectly coupled telephone system is reported which transmits/to a central receiving site eight channels of EEG data of sufficient fidelity for screening and/or limited diagnostic use. The system requires no electrical connection to the telephone at the transmitter or at the receiver and is compatible with common EEG recording practice for real-time recording. It accepts 8 input channels simultaneously with one telephone transmitter and one telephone receiver operates from standard power sources. Author

N73-20187*# Ohio State Univ., Columbus. Electroscience Lab.
AN INTEGRAL-EQUATION SOLUTION FOR TE RADIATION AND SCATTERING FROM CONDUCTING CYLINDERS
J. H. Richmond Washington NASA Apr. 1973 82 p refs
(Grant NGL-36-008-138)
(NASA-CR-2245; TR-2902-7) Avail: NTIS HC $3.00 CSCL 20N

The piecewise-sinusoidal reaction technique is applied to low frequency radiation and scattering from noncircular cylinders with perfect or imperfect conductivity. This report presents the theory, computer programs and numerical results for these two-dimensional problems with the TE polarization. Author

N73-20188*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR THE PIONEER PROJECT. VOLUME 1: PIONEER 10-PRELAUNCH PLANNING THROUGH SECOND TRAJECTORY CORRECTION, 4 DECEMBER 1969 - 1 APRIL 1972
A. J. Siegmeth, R. E. Purdue, and R. E. Ryan 1 Apr. 1973 410 p
(Contract NAS7-100)
(NASA-CR-131373; JPL-TM-33-584-Vol-1) Avail: NTIS HC $22.50 CSCL 17I

The tracking and data system support of the launch, near-earth, and deep space phases of the Pioneer 10 mission, which sent a Pioneer spacecraft into a flyby of Jupiter that would eventually allow the spacecraft to escape the solar system is discussed. The support through the spacecraft's second trajectory correction is reported. During this period, scientific instruments aboard the spacecraft registered information relative to interplanetary particles and fields, and radiometric data generated by the network continued to improve knowledge of the celestial mechanics of the solar system. In addition to network support activity detail, network performance and special support activities are covered. Author

N73-20189# Bendix Corp., Towson, Md. Communications Div.
SYNCHRONIZED DISCRETE ADDRESS BEACON SYSTEM (SYNCHRO-DABS) STUDY Final Report, 31 Mar. 1972 - 8 Jan. 1973
A. D. McComas and Wayne G. Shear Jan. 1973 385 p refs
(Contract DOT-FA72WA-2888)
(SD-FR-01; FAA-EM-73-1) Avail: NTIS HC $21.25

A study to determine the problems, benefits, and costs of synchronizing the DABS system such as to provide each airborne participant with certain optional aeronautical services was conducted. A system concept is developed and documented to the extent necessary to establish a basis for estimating the costs of representitive avionics options. The costs and technical descriptions of 12 configurations are developed to various degrees, beginning with a basic DABS transponder with IPC and progressing through ATC Data Link, PWI, CAS, DME and cockpit PPI displays. Author

N73-20190*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASCOM NETWORK: GROUND COMMUNICATIONS RELIABILITY REPORT
Feb. 1973 59 p
(NASA-TM-X-66220; X-843-73-41) Avail: NTIS HC $5.00 CSCL 17B

A reliability performance analysis of the NASCOM Network circuits is reported. Network performance narrative summary is presented to include significant changes in circuit configurations, current figures, and trends in each trouble category with notable circuit totals specified. Lost time and interruption tables listing circuits which were affected by outages showing their totals category are submitted. A special analysis of circuits with low reliabilities is developed with tables depicting the performance and graphs for individual reliabilities. Author

N73-20191# Naval Undersea Research and Development Center, San Diego, Calif.
THE USE OF AN INSTRUMENTED MARINE MAMMAL AS AN OCEANOGRAPHIC SURVEY PLATFORM
William E. Evans and James S. Leatherwood Dec. 1972 18 p refs
(AD-754761; NUC-TP-331) Avail: NTIS CSCL 09/6

The paper reports the second phase of an effort to use instrumented marine mammals to measure selected environmental parameters and to relay data on these parameters to tracking aircraft and ultimately to orbiting satellites. A Pacific common dolphin, Delphinus delphis, was fitted with an instrument package and tracked from shipboard and from specially equipped Navy S-2D aircraft. The preferability of smaller odontocetes over larger mystictes as environmental survey platforms was demonstrated. Data collected compared favorably with data from previous radio tracks and with on-site measurements using conventional sampling techniques. Maximum transmitter range and optimum tracking and data collection altitudes were demonstrated for present systems. Author (GRA)

N73-20192# Army Missile Command, Redstone Arsenal, Ala.
ON THE STATISTICAL MODELING OF RADAR TARGETS
James W. Wright and Abraham H. Haddad Nov. 1972 139 p refs
(AD-753936; RE-TR-72-19) Avail: NTIS CSCL 17/9

The objective of this research is to develop techniques and procedures for computing the statistical characteristics of some electromagnetic scattering phenomena from radar targets. Radar measurements are perturbed by electromagnetic scattering phenomena induced by complex targets including radar cross section scintillation and glint or position error. The statistical characteristics of these phenomena may be used to evaluate radar system performance, develop optimum tracking systems, and develop stochastic models to use in system simulations. Author (GRA)

N73-20193# Naval Research Lab., Washington, D.C.
PROCEEDINGS OF THE CONFERENCE ON ANTENNAS AND TRANSIONOSPHERIC PROPAGATION AS RELATED TO ELF/VLF DOWNLINK SATELLITE COMMUNICATIONS
Loren S. Bearce 27 Nov. 1972 349 p refs Conf. held at Washington, D. C., 8-10 Jun. 1970
(NRL Proj. R01-44)
(AD-754061; NRL-7462) Avail: NTIS CSCL 17/2

An initial conference on Antennas and Transionospheric Propagation as related to ELF/VLF Downlink Satellite Communications was held for the purpose of providing a forum for interested people to review pertinent physical principles and data, recent theoretical and experimental results, and current thinking; to stimulate and focus attention on appropriate new activity for further studies; and to allow participants an opportunity to present and discuss recommendations for pertinent experimentation, related instrumentation, and studies considered to be most timely and meaningful for implementation in the 70's. The report contains the agenda and abstracts and/or papers for most of the formal presentations. GRA

N73-20194# Ohio Univ., Athens. Dept. of Electrical Engineering.
PROPAGATION CHARACTERISTICS OF VLF WAVES BELOW A STRATIFIED AND GENERALLY ANISOTROPIC IONOSPHERE
David W. Pidwell Oct. 1972 88 p refs
(Contract DAAB07-68-C-0084)
(AD-754033; EER-16-9; ECOM-0084-5-7) Avail: NTIS CSCL 20/14

The research constitutes one method of formulation for the calculation of very low frequency radio wave propagation characteristics of the earth-ionosphere waveguide. It involves a brief consideration of some general properties of the ionosphere which influence the propagation of VLF (very low frequencies) waves. In the analysis, the waveguide is the area formed by the earth and the lower conducting region of the ionosphere. The propagation characteristics are obtained from the solution of a modal equation which is formulated directly in terms of the reflection coefficients of both the ionosphere and earth. The coupled vacuum mode theory of Poeverlein is extended to include the earth's curvature effects by assuming the ionosphere as a cylindrical stratified medium. The modal equation is solved by an iterative procedure and propagation characteristics are obtained for a variety of ionospheric conditions for different directions of propagation. A comparison of the numerical results is made with different formulations in the literature. Author (GRA)

N73-20195# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORETICAL PRINCIPLES OF A RADAR (SELECTED PARTS)
28 Sep. 1972 19 p refs Transl. into ENGLISH from the book "Teor. Osnovy Radiolokatsii" Moscow, Izd-vo Sovetskoye Radio, 1970 p 479-483, 542-549

(AD-753963; FTD-HT-23-892-72) Avail: NTIS CSCL 17/9

The report discusses methods for decreasing the number of blind speed zones during a selection of moving targets. GRA

N73-20196# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OBSERVATIONS OF A SYNCHRONOUS SATELLITE WITH THE HAYSTACK RADAR
Gordon L. Guernsey and Chaloner B. Slade 13 Dec. 1972 35 p refs
(Contract F19628-73-C-0002; AF Proj. 1228)
(AD-754937; TN-1972-14; ESD-TR-72-351) Avail: NTIS CSCL 17/9

The Haystack planetary radar has been used to observe the Lincoln Experimental Satellite (LES-6). The principal characteristics of the radar signature derived from these observations are related to the physical features of the satellite. Author (GRA)

N73-20197# Airborne Instruments Lab., Deer Park, N.Y.
REDUCTION OF TRANSMITTER INTERMODULATION PRODUCT SIGNALS IN AIR FORCE COMMUNICATIONS SYSTEMS Final Technical Report, Mar. 1971 - Mar. 1972
N. Worontzoff, H. Levy, and Y. DeGruyl Dec. 1972 65 p refs
(Contract F30602-71-C-0222)
(AD-754938; AIL-5365-1; RADC-TR-72-312) Avail: NTIS CSCL 17/2

The report describes the results of a program investigating means of reducing the intermodulation products generated in collocated 100-watt transmitters operating in the 225 to 400 MHz frequency range. The IM reduction technique considered a cascade of four tunable isolators and a standard tunable filter to achieve a net antenna-to-transmitter isolation of 80 db. The major accomplishment on the program was the development of a tunable, compact, lumped-parameter UHF isolator having a power handling level in excess of 100 watts with a typical forward loss of 0.5 db, and a 20-db isolation bandwidth of 4.3 to 7.6 percent. Author (GRA)

N73-20198# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
AN ENGINEERING FEASIBILITY STUDY OF COMMUNICATIONS VIA A SUBTERRANEAN WAVEGUIDE
R. L. Gallawa and L. L. Haidle Nov. 1972 136 p refs
(Contract NAonr-12-71; NR Proj. 081-273)
(AD-754786; OT/TRER-39) Avail: NTIS CSCL 17/2

The report considers the signal strength at a point in a subterranean waveguide and compares it with the noise one might expect. Noise that is owing to atmospheric and subsurface thermal sources. The signal is due to a transmitting antenna located in the waveguide. A prediction is thus made on signal-to-noise ratio at the receiving point. The prediction permits an engineering estimate of the likely distance one could communicate via this subterranean waveguide, based on assumed waveguide parameters. Author (GRA)

N73-20199# Naval Weapons Lab., Dahlgren, Va.
STEREO ANTENNA PATTERNS FROM PRINCIPAL PLANE PATTERNS
Joseph H. Halberstein Nov. 1972 30 p
(UF53533401)
(AD-754782; NWL-TR-2812) Avail: NTIS CSCL 09/5

In most antenna applications, it is sufficient to consider antenna patterns in two dimensions only, mostly the two-dimensional patterns in the principal planes. When antennas are considered from the electromagnetic compatibility (EMC) and electronic countermeasures (ECM) point of view, the STEREO-three-dimensional patterns become of interest. The question then arises whether it is possible to obtain the gain in an arbitrary direction from the gain patterns as measured in the two principal planes. The report answers this question in the affirmative for rectangular apertures and in the angular region around the antenna where its pattern is adequately represented by an aperture integral. Author (GRA)

N73-20200# Army Strategic Communications Command, Fort Huachuca, Ariz.
OPTICAL FIBER LINKS FOR TELECOMMUNICATIONS, PART 1
Stephen F. Fulghum, Jr. and James J. Burke Dec. 1972 98 p refs
(AD-754566) Avail: NTIS CSCL 17/2

The purpose of the report is to provide a physical understanding of fiber optics communications. The report covers the basics of light guidance in optical fibers from both geometrical and waveguide points of view. This includes attenuation and the effects of pulse broadening on information rate. Light sources, detectors and coupling are also covered with an emphasis on semiconductor devices. Finally, the present state and future prospects of integrated optics are discussed. Communication systems using fiber optics have advantages over conventional systems. These advantages are due mainly to the high bandwidths possible at optical frequencies and to the fact that glass fibers are not electrical conductors. Fiber optics may be the answer to problems of electromagnetic interference, electrical isolation and security. These systems will be useful where high bandwidth, small size, cable flexibility and low weight are needed. Author (GRA)

N73-20201# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
SPATIAL STATISTICS OF INSTRUMENT-LIMITED ANGULAR MEASUREMENT ERRORS IN PHASED ARRAY RADARS Final Report, May 1971 - Jul. 1972
R. H. Sahmel and R. Manasse 2 Oct. 1972 66 p refs
(Contract F04701-72-C-0073)
(AD-754922; TR-0073(3901-02)-1; SAMSO-TR-72-309) Avail: NTIS CSCL 17/9

The principal contributors to the random component of the instrument limited angular measurement errors in electronically scanned phased array radars are reviewed and formulas are developed for statistical modeling of these error sources. A comprehensive computer program, embodying this analysis, has been developed for determining these array measurement errors and their spatial correlation statistics, in two angle variables. This program includes the effect of finite computation accuracy in the beam steering computer. The error model employed is valid for space-fed and certain types of corporate-fed arrays. This program is used to evaluate the statistical behavior of angular errors for some typical situations of interest. The use of angle, frequency, and phase dithering for improving the correlation statistics of these arrays is examined. Author (GRA)

N73-20202# Innsbruck Univ. (Austria). Electronics Lab.
MATHEMATICAL CLASSIFICATION AND DESCRIPTION OF THE RESPONSE CHARACTERISTIC IN THE ELLIPTICALLY POLARIZED VLF AND LF FIELD
Richard J. L. Klein 30 Sep. 1972 32 p refs
(Contract F44620-72-C-0052; AF Proj. 4600)
(AD-754906; AFCRL-72-0671; SR-3) Avail: NTIS CSCL 17/3

A systematic classification and mathematical description of the three dimensional response characteristic of a direction finding antenna in an elliptically polarized field is given. Furthermore, the areas occuring at the intersection of the pedaloid with a plane are described. Finally the squint is calculated that arises when the direction finder is not rotated in the plane of the polarization ellipse but in another one when measuring the maximum of field strength. Author (GRA)

N73-20203# Army Foreign Science and Technology Center, Charlottesville, Va.
A BASIC-MODE WAVE ATTENUATOR IN A MULTIMODE WAVE GUIDE
V. S. Smolovik 6 Jul. 1972 3 p Transl. into ENGLISH from Opisanie Izobreteniya k Avtorskomu Svidetelstvu (USSR), no. 1, 18 Dec. 1965
(AD-754516; FSTC-HT-23-1869-72) Avail: NTIS CSCL 09/1

A basic-mode wave attenuator providing smooth attenuation of basic mode waves by including an array or plates on a common movable plate to act as generators of higher-mode waves is described. Author (GRA)

N73-20204# Ohio State Univ., Columbus. Electroscience Lab.
AN INVESTIGATION OF THE EFFECTS OF A LOSSY EARTH ON ANTENNA PATTERNS AT VHF
Edward H. Newman Dec. 1972 77 p refs
(Contract DAAG39-72-C-0041; HDL Proj. 117215)

(AD-754637; HDL-3281-1) Avail: NTIS CSCL 09/5

The objective of the report is to theoretically investigate the potential of several low profile antennas for use at or near ground level locations, as compared with a quarter wavelength monopole. Of specific interest is the radiated field intensity at low elevation angles produced by VHF multiturn loop antennas having various orientations with respect to a flat lossy earth. Author (GRA)

N73-20205# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

OPTIMAL RECEPTION OF A CLASS OF SIGNALS IN THE PRESENCE OF A PRIORI UNKNOWN STATISTICS

M. S. Lokhvitskii and V. V. Shakhgildyan 22 Dec. 1972 13 p refs Transl. into ENGLISH from 4th Kone. po Teorii Peredachi i Kodirovaniya Inform., 29 Sep. - 4 Oct. 1969 p 121-126

(AD-754603; FTD-HT-23-1665-72) Avail: NTIS CSCL 09/4

The paper discusses the problem of reception of a phase manipulated signal on a noise background in the presence of unknown noise statistics and a priori probabilities of values of the information parameter. The number of values which the signal can assume is presumed to be known. Algorithms for obtaining continuous estimates of the parameters of the useful signal and for determining boundaries of various classes are derived. Author (GRA)

N73-20206# Naval Research Lab., Washington, D.C.

DESIGN CONSIDERATIONS OF A PROGRAMMABLE PREDICTION DIGITAL SIGNAL PROCESSOR FOR RADAR APPLICATIONS Interim Report

Barry P. Shay 13 Dec. 1972 58 p refs

(XF53241003)

(AD-754060; NRL-7455) Avail: NTIS CSCL 17/9

Signal processing tasks normally encountered in a radar system, such as pulse compression and moving target indication, are defined in terms of recursive and nonrecursive digital filtering and the discrete Fourier transform. Analysis of these algorithms reveals that the general second-order recursive filter and the Fast Fourier Transform butterfly are kernels which should be efficiently executed by a Radar Arithmetic Processing Element (RAPE). This element would be the arithmetic unit of an envisioned programmable signal processor. With associated memory and a small microprogrammed control unit, this element could be an independent, general-purpose signal processor. As such, it may represent an off-the-shelf module capable of replacing a wide range of existing special-purpose hardware. Author (GRA)

N73-20207# Mitre Corp., Bedford, Mass.

SUMMARY OF FY 1972 ACTIVITIES ON AIR FORCE SYSTEMS COMMAND (AFSC) PROGRAM 634A: COMMUNICATION, NAVIGATION IDENTIFICATION (CNI) SYSTEM DEVELOPMENT PLANNING

E. Ferrari Dec. 1972 86 p refs

(Contract F19628-73-C-0001; AF Proj. 691A)

(AD-754930; MTR-2441; ESD-TR-72-333) Avail: NTIS CSCL 17/2

The objectives of AFSC Program 634A are to identify and evaluate new approaches for fulfilling Air Force common-user communications, navigation and identification requirements. This report describes the activities and status of efforts in the areas of requirements, message traffic, equipment data base, costs, design and evaluation criteria, and system concepts. Author (GRA)

N73-20208# Massachusetts Inst. of Tech., Cambridge.

SATELLITE TELEVISION FOR INDIA: TECHNO-ECONOMIC FACTORS

R. C. Butman 28 Sep. 1972 62 p refs Sponsored by Agency for Intern. Develop.

(PB-213226; TA/OST-AN-72-9-1) Avail: NTIS HC $3.00 CSCL 17B

The techno-economic aspects of the use of satellites for equation and instruction in India are studied by available trade-offs between satellite and terrestrial television networks. Some of the topics covered include: The objectives of a nationwide television network in India; general system principles which bear on the selection of a television/telecommunications system; terrestrial broadcast transmitter equipment and coverage costs; relay and telecommunications considerations; comparative costs of satellite and terrestrial systems. Author (GRA)

N73-20209# Michigan Univ., Ann Arbor. Radiation Lab.

DIFFRACTION, SCATTERING AND IMPEDANCE LOADING

Thomas B. A. Senior and Valdis V. Liepa Oct. 1972 33 p refs

(Contract F19628-68-C-0071; AF Proj. 5635)

(AD-754899; Rept-01360-1-F; AFCRL-72-0617) Avail: NTIS CSCL 17/9

Two of the main topics were the investigation of the impedance loading technique with particular emphasis on the development of a broadband realization, and the study of scattering from periodic surfaces, but a variety of other scattering and diffraction problems were also considered. Author (GRA)

N73-20210# Rome Air Development Center, Griffiss AFB, N.Y.

COMPARATIVE PERFORMANCE EVALUATION OF COMMON AND SPECIAL GRADE CONUS AUTOVON TRUNKS, PHASE 2 Technical Report, Sep. 1970 - Apr. 1971

J. Russell Lemon Dec. 1972 135 p ref

(AF Proj. 9397)

(AD-754921; RADC-TR-72-317) Avail: NTIS CSCL 17/2

Phase II of the AUTOVON Evaluation was a quantitative evaluation of Special Grade and Common Grade AUTOVON Trunks conducted at the RADC Digital Communications Experimental Facility (DICEF) during the period of September 1970 to April 1971. The results provide factual data on the digital and analog performance of these circuits. Phase II of the AUTOVON Evaluation compared the performance of Special Grade Trunks, Common Grade Trunks, and Common Grade Trunks with a fixed corrective equalization. These trunks were evaluated using phase modulated and amplitude modulated type MODEM's. The MODEM's were operated at data rates of 2400, 4800, and 9600 bits per second. Author (GRA)

N73-20211# Ohio State Univ., Columbus. Electroscience Lab.

ADAPTIVE ANTENNAS FOR SPREAD SPECTRUM COMMUNICATION SYSTEMS Interim Technical Report

D. C. Upp and R. T. Compton, Jr. Oct. 1972 31 p refs

(Contract N00014-67-A-0232-0009)

(AD-754444; ESL-3098-3) Avail: NTIS CSCL 09/5

The primary purpose is to investigate the interference rejection capability of an adaptive array in a spread spectrum communication system and to determine the design tradeoffs for such a system. This report describes the implementation of the reference signal generation loop and the delay-lock tracking-loop. Author (GRA)

N73-20212# Naval Postgraduate School, Monterey, Calif.

THE EFFECT OF ROLL AND PITCH ON ANTENNA RADIATION PATTERNS M.S. Thesis

Stanley Robert Szemborski Sep. 1972 192 p refs

(AD-754348) Avail: NTIS CSCL 09/5

The strength of an incoming signal to a shipboard communications station is measured. The variations in this signal are analyzed for various conditions of roll, pitch, and signal direction. Graphs and computer outputs are used to present the magnitude and randomness of these signal variations. A smooth surface approximation is used to simulate the problem, and this simulation is compared to observed data. Author (GRA)

N73-20213# Naval Electronics Lab. Center, San Diego, Calif.

EFFECT OF THE VLF PROPAGATION CHANNEL ON SPREAD-SPECTRUM COMMUNICATION SYSTEMS Research and Development Report, Mar. 1971 - Jun. 1972

I. J. Rothmuller 4 Aug. 1972 69 p refs

(AD-755122; NELC-TR-1834) Avail: NTIS CSCL 17/2

The effect of propagation on the performance of a differentially coherent, MSK communication system having a demodulator not matched to the channel is determined. The system performance level is found to be dependent on the dispersion characteristics of the channel transfer function. Near deep interference minima, performance increased as the bandwidth increased. For the particular sharp null studied, improvement of up to 20 db above the level expected by a cw system operating at the center frequency was obtained. Up to 4-db further improvement can be gained at wide bandwidths for sharp, deep nulls by implementation of a demodulator which matches the channel. The extreme

phase dispersion at interference minima, which was expected to cause severe degradation, in fact caused only 2-to-3-db degradation. Author (GRA)

N73-20214# Naval Postgraduate School, Monterey, Calif.
NUMERICAL SOLUTION OF THE FOKKER-PLANCK EQUATION FOR THE FIRST ORDER PHASE-LOCKED LOOP M.S. Thesis
Allan Rutherford Sep. 1972 53 p refs
(AD-754355) Avail: NTIS CSCL 09/4

The transient behavior of the phase error probability density function of a first-order phase-locked loop in the presence of additive white Gaussian noise is determined using numerical techniques. In addition, the modulo-2pi probability density function and the cycle slipping density function are found. The algorithm used in these analyses involves numerical integration of a normalized and factored Fokker-Planck equation. Results are shown for cases involving various signal-to-noise ratios and initial conditions. Author (GRA)

N73-20215# Naval Research Lab., Washington, D.C.
POTENTIAL APPLICATIONS OF OTHER RADAR TECHNOLOGY TO CIVIL MARINE RADAR Final Report
Merrill I. Skolnik and William V. Haddix Jan. 1973 25 p refs (RF12151402)
(AD-754408; NRL-MR-2548) Avail: NTIS CSCL 17/9

Military radar research and development has generated many techniques which have distinct possible application to civil marine radar. Developments such as pulse compression, ship imaging, and solid state radar to name a few, which were selected for both appropriateness and potential interest to the civil marine radar community, are presented without regard to the economics involved. Recent advances in sea clutter theory and its potential impact on marine radar design are also discussed. An appendix is included which presents a summary of recent data on ship's cross section. It was found that the cross section in sq meters could be expressed as sigma = 52 root of f D to the 1.5th power, where f is the radar frequency in megahertz and D is the ship displacement in kilotons. Author (GRA)

N73-20216# Hawaii Inst. of Geophysics, Honolulu.
DESIGN SPECIFICATIONS FOR A LONG-RANGE SWATH-MAPPING SONAR
Paul Jubinski May 1972 36 p
(Contract N00014-67-A-0367-0004)
(AD-755113; HIG-72-12) Avail: NTIS CSCL 17/1

Design specifications are presented for a transducer array operating at 3.5 kHz and capable of bathymetric mapping over a swath of at least 25 nautical miles across the ship's track. Beam shaping was determined solely by transducer placement. Specifications are given for the beam transmission patterns and comparisons are made to a hypothetical array which would illuminate the ocean bottom uniformly. Signal-flow and processing designs are provided for application of the array to the detection of large-scale bathymetric features above the mean ocean depth. The entire system will provide a coverage of 250 (n. miles) squared/ hour from a 10-knot research vessel. Author (GRA)

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N73-20217* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RATE DATA ENCODER Patent
Wilford E. Sivertson, Jr., inventor (to NASA) Issued 30 Jan. 1973 6 p Filed 26 Oct. 1970 Supersedes N72-15177 (10 - 06, p 0738)
(NASA-Case-LAR-10128-1; US-Patent-3,714,645; US-Patent-Appl-SN-84002; US-Patent-Class-340-347AD; US-Patent-Class-235-92R; US-Patent-Class-235-92FQ; US-Patent-Class-235-92T) Avail: US Patent Office CSCL 09B

An apparatus and technique for encoding rate data is described. The expected range of the rate data is determined and the data falling within that range is encoded by conventional digital techniques. If the data falls either below or above the range, the encoding is stopped and signals are transmitted indicating that the data is not within the expected range.
Official Gazette of the U.S. Patent Office

N73-20218 National Lending Library for Science and Technology, Boston Spa (England).
DATA PROCESSING SYSTEM BY COMPUTER FOR GC/MS
N. Makoto et al Nov. 1972 16 p refs Transl. into ENGLISH from Shitsuryo Bunseki (Tokyo), v. 19, no. 3, 1971 p 225-234 (NLL-RTS-7572) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.50; 5 NLL photocopy coupons

A system for the full automation of GC/MS system data acquisition and processing was experimentally constructed and the following results were obtained from examining various conditions and its utility. (1) The optimum conditions for using this system at an acceleration voltage of 1800 are a sampling interval of from 220 micro sec or 250 micro sec and a scanning speed of 5 sec. Data obtained under these conditions give accurate mass numbers up to m/e 300, and data obtained from the Vidigraph agreed well with the pattern coefficient, therefore they can be used for qualitative analysis (automatic scanning). (2) Mass spectra obtained from scanning intervals between gas chromatographic peaks did not differ from the results of scanning gas chromatographic peak crests, therefore it was possible to use the auto-scanner, and the entire processes from data acquisition to processing was automated. (3) Calibration curves made from the use of PFK could be used later where there was no change in the mass analysis measuring conditions. Author

N73-20219*# Intermetrics, Inc., Cambridge, Mass.
MULTIPROCESSOR ARCHITECTURAL STUDY Final Report
Alex L. Kosmala, Saul F. Stanten, and Woodrow H. Vandever Nov. 1972 166 p refs
(Contract NAS8-28605)
(NASA-CR-124151; TR-01-73) Avail: NTIS HC $10.50 CSCL 09B

An architectural design study was made of a multiprocessor computing system intended to meet functional and performance specifications appropriate to a manned space station application. Intermetrics, previous experience, and accumulated knowledge of the multiprocessor field is used to generate a baseline philosophy for the design of a future SUMC multiprocessor. Interrupts are defined and the crucial questions of interrupt structure, such as processor selection and response time, are discussed. Memory hierarchy and performance is discussed extensively with particular attention to the design approach which utilizes a cache memory associated with each processor. The ability of an individual processor to approach its theoretical maximum performance is then analyzed in terms of a hit ratio. Memory management is envisioned as a virtual memory system implemented either through segmentation or paging. Addressing is discussed in terms of various register design adopted by current computers and those of advanced design. Author

N73-20220*# TRW Systems, Redondo Beach, Calif.
STUDY OF THE DYNAMICS OF ORBITAL ASSEMBLIES INCLUDING INTERACTIONS WITH GEOMETRICAL APPENDAGES
G. Hull and D. J. Ness Dec. 1972 22 p refs
(Contracts NAS8-26131; NAS8-28169)
(NASA-CR-124169; TRW-14938-6011-R0-00) Avail: NTIS HC $3.25 CSCL 09B

Computer programs are provided for the simulation of a unified flexible spacecraft relative to the dynamics of orbital assemblies, including interactions with geometrical appendages. The CDC 6500 and Univac 1108 computers are used with FORTRAN. The software and hardware requirements are described and diagrammed, as well as the overall deck set-up. A list of standard and nonstandard routines is also included.
J.M.M.

N73-20221# National Research Council of Canada, Ottawa (Ontario). Hydraulics Lab.
COMPUTER CONTROL AND DATA ACQUISITION OF A TIDAL MODEL

E. R. Funke Dec. 1972 93 p refs
(MH-10) Avail: NTIS HC $6.75

A large tidal model of the St. Lawrence River covering the region from Montreal to Ile du Bic is connected directly to a mini computer for data acquisition and control of the tidal boundary. Concepts for the design and operation of a computer based system for this application are described. Details of an adaptive feedback controller for diurnal tides are given. Author

N73-20222*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A HIGH SPEED SEQUENTIAL DECODER
Henry Lum, Jr. Dec. 1972 191 p
(NASA-TM-X-62241) Avail: NTIS HC $11.75 CSCL 09B

The performance and theory of operation for the High Speed Hard Decision Sequential Decoder are delineated. The decoder is a forward error correction system which is capable of accepting data from binary-phase-shift-keyed and quadriphase-shift-keyed modems at input data rates up to 30 megabits per second. Test results show that the decoder is capable of maintaining a composite error rate of 0.00001 at an input E sub b/N sub o of 5.6 db. This performance has been obtained with minimum circuit complexity. Author

N73-20223# National Bureau of Standards, Washington, D.C.
DESCRIPTION OF THE MAGNETIC TAPE VERSION OF THE BULLETIN OF THERMODYNAMICS AND THERMOCHEMISTRY, NO. 14 (1971)
Robert McClenon, William H. Evans, David Gavin, and Blanton C. Duncan Mar. 1973 49 p ref
(NBS-TN-760) Avail: SOD $0.75 domestic postpaid or $0.50 GPO Bookstore CSCL 05B

The substance-property index and bibliography were converted to a magnetic tape version designed for computerized searching written in an extended form. In this version each substance-property entry was supplemented by a searching key. The magnetic tape version is described. Author

N73-20224# Utah Univ., Salt Lake City.
DISPLAYING COMPUTER GENERATED HALF-TONE PICTURE IN REAL TIME Final Technical Report
A. C. Erdahl Griffiss AFB, N. Y. RADC Aug. 1972 67 p refs
(Contract AF 30(602)-4277; ARPA Order 829)
(AD-753672; TR-4-14; RADC-TR-69-250) Avail: NTIS CSCL 09/2

A system is described which will allow computer generated half-tone pictures to be displayed in real time. Half-tone or shaded pictures are valuable since they allow object surfaces to be displayed. The picture must first be described in terms of its visible surface boundaries. This is a convenient form since the information required is produced by the hidden line algorithms used to generate the picture. Such a form usually represents a substantial savings in the number of bits required to describe a picture. A display generator is described which will convert these edge descriptions into intensity values which can then be displayed on a faster scan device. The picture can then be displayed directly on an oscilloscope or placed on a storage disk which will refresh a standard television set. Author (GRA)

N73-20225# California Univ., Los Angeles.
SOME RECENT ADVANCES IN COMPUTER COMMUNICATIONS
Wesley W. Chu 1972 8 p refs Presented at 1st USA-Japan Computer Commun., Tokyo, 3-5 Oct. 1972
(Contracts N00014-69-A-0200-4027; DAHC15-69-C-0285; NR Proj. 048-129)
(AD-754461) Avail: NTIS CSCL 09/2

Recent advances in computer communications are discussed, including: (1) Computer traffic characteristics in the case of long holding time representing scientific applications, and in the case of short holding time representing the inquiry-response systems; (2) Telephone channel error characteristics of high speed voice band data transmission on the switched telecommunication network, and of the low speed channel at a rate of 300 bits/sec; (3) Optimal fixed message block size for communication systems using error detection and retransmission as error control (with random or burst error channel); (4) Statistical multiplexing (Asynchronous Time Division Multiplexing); (5) Loop systems; (6) Security in computer communications. New areas needing further investigation are included. Author (GRA)

N73-20226# Mitre Corp., Bedford, Mass.
COMPARISON OF REQUEST HANDLING CAPABILITY OF SOME AIRBORNE DRUM MEMORIES
Norman B. Sutherland Dec. 1972 43 p
(Contract F19628-71-C-0002; AF Proj. 6700)
(AD-754933; MTR-2434; ESD-TR-72-327) Avail: NTIS CSCL 09/2

A method is described for developing a consistent framework for comparing the request handling capabilities of various drum memories. The method permits one to estimate the request capacity of a drum, given its physical characteristics together with a number of assumptions regarding such factors as data organization, blocking average quantity of data transferred per request, and effective latency time. The method developed is used to compare the capability of several existing or proposed airborne drums. The effect of a number of possible modifications to a particular drum (e.g., increase density, increased rotational speed, reduction of number of overhead bits) is also examined. Author (GRA)

N73-20227# Utah Univ., Salt Lake City.
GRAPHICAL MAN/MACHINE COMMUNICATIONS Semiannual Technical Report, 1 Jan. - 30 Jun. 1972
David C. Evans Griffiss AFB, N. Y. RADC Jun. 1972 73 p refs
(Contract F30602-70-C-0300; ARPA Order 829)
(AD-754282; RADC-TR-72-268) Avail: NTIS CSCL 09/2

The objective of the graphical man/machine communication effort is the development of computers and computing techniques that people may use interactively in real time to extend their problem-solving capability, and to work cooperatively by means of improved communications via computer. This report summarizes the progress made in four major areas: (1) computer graphics techniques, (2) computing systems, (3) digital waveform processing, and (4) symbolic and algebraic manipulations. GRA

N73-20228# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INTERFACE MESSAGE PROCESSORS FOR THE ARPA COMPUTER NETWORK Quarterly Technical Report, 1 Oct. - 31 Dec. 1972
Frank E. Heart Jan. 1973 45 p refs
(Contract DAHC15-69-C-0179; ARPA Order 1260)
(AD-754441; BBN-2499; QTP-16) Avail: NTIS CSCL 09/2

The basic function of the ARPA computer network is to allow large existing computers (Hosts), with different system configurations, to communicate with each other. Each Host is connected to an Interface Message Processor (IMP), which transmits messages from its Host(s) to other Hosts and accepts messages for its Hosts(s) from other Hosts. There is frequently no direct communication circuit between two Hosts that wish to communicate; in these cases intermediate IMPs act as message switchers. The message switching is performed as a store and forward operation. The IMPs regularly exchange information. A High Speed Modular IMP is under development; one goal of this effort is to increase IMP performance by a factor of 10. GRA

N73-20229# Ohio Univ., Athens. Dept. of Electrical Engineering.
FREQUENCY DIVISION WITH RIPPLE COUNTERS
Ralph W. Burhans Oct. 1972 16 p
(Contract DAAB07-68-C-0084)
(AD-754030; EER-16-14; ECOM-0084-S-4) Avail: NTIS CSCL 09/2

A method of programming binary ripple counters for adding or subtracting counts to provide any integral division ratio is presented. The technique is particularly useful in extending the range of a given counter chain a few counts beyond the normal binary count. Thus, a 4 bit binary counter normally dividing by 16, can be made to divide by 17, 18, 19,---without introducing pulse width variations due to external RC timing networks. Author (GRA)

N73-20230# Naval Weapons Lab., Dahlgren, Va.
THE CASUALTY DATA REDUCTION PROCESSOR PRO-

GRAM
Larry W. Freeman Sep. 1972 195 p refs
(AD-754426; NWL-TR-2814; CPG-73-0050) Avail: NTIS CSCL 09/2

The document describes the Casualty Data Reduction (CDR) Processor Program which serves to facilitate and automate the collection of Poseidon MK 88 Digital Control Computer (DCC) casualty data. It is part of a software checkout system, and assists in generating a fault dictionary. Author (GRA)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N73-20231* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SELF-TUNING BANDPASS FILTER Patent
Gordon J. Deboo and Roger C. Hedlund, inventors (to NASA) Issued 30 Jan. 1973 8 p Filed 13 Oct. 1970 Supersedes N72-15200 (10 - 06, p 0742)
(NASA-Case-ARC-10264-1; US-Patent-3,714,588; US-Patent-Appl-SN-80368; US-Patent-Class-328-167; US-Patent-Class-330-86; US-Patent-Class-330-109) Avail: US Patent Office CSCL 09E

An electronic filter is described which simultaneously maintains a constant bandwidth and a constant center frequency gain as the input signal frequency varies, and remains self-tuning to that center frequency over a decade range. The filter utilizes a field effect transistor (FET) as a voltage variable resistance in the bandpass frequency determining circuit. The FET is responsive to a phase detector to achieve self-tuning. Official Gazette of the U.S. Patent Office

N73-20232* National Academy of Sciences-National Research Council, Washington, D.C.
GYRATOR EMPLOYING FIELD EFFECT TRANSISTORS Patent
Erwin S. Hochmair, inventor (to NASA) Issued 6 Feb. 1973 10 p Filed 20 Mar. 1972 Supersedes N72-21255 (10 - 12, p 1587) Sponsored by NASA
(NASA-Case-MFS-21433; US-Patent-3,715,693; US-Patent-Appl-SN-236281; US-Patent-Class-330-80T; US-Patent-Class-307-230; US-Patent-Class-307-304; US-Patent-Class-330-20; US-Patent-Class-330-22; US-Patent-Class-330-30D; US-Patent-Class-330-35; US-Patent-Class-330-40) Avail: US Patent Office CSCL 09E

A gyrator circuit of the conventional configuration of two amplifiers in a circular loop, one producing zero phase shift and the other producing 180 deg phase reversal is examined. All active elements are MOS field effect transistors. Each amplifier comprises a differential amplifier configuration with current limiting transistor, followed by an output transistor in cascode configuration, and two load transistors of opposite conductivity type from the other transistors. A voltage divider control circuit comprises a series string of transistors with a central voltage input to provide control, with locations on the amplifiers receiving reference voltages by connection to appropriate points on the divider. The circuit produces excellent response and is well suited for fabrication by integrated circuits. Official Gazette of the U.S. Patent Office

N73-20233 National Lending Library for Science and Technology, Boston Spa (England).
VIDICONS OF INCREASED SENSITIVITY
A. S. Markinsov et al 4 Dec. 1972 9 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), v. 6, Jun. 1972 p 53-55
(NLL-DRIC-Trans-2965-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The increased sensitivity of vidicons with electrostatic and electrostatic-magnetic beam control was measured and compared to standard models. Variations in signal strength and light and dark currents were analyzed as a function of photoconducting layer thickness. Results show that variations were about the same in both vidicons for all targets tested regardless of target thickness (though it should be noted that only the better examples of targets made by the old method were tested). E.H.W.

N73-20234 National Lending Library for Science and Technology, Boston Spa (England).
PULSE CHARACTERISTICS CURVES OF VIDICONS
I. A. Rumyantsev et al 4 Dec. 1972 9 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), v. 4, 1972 p 64-66
(NLL-DRIC-Trans-2875-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The characteristics of pulse modulated beam currents of a vidicon beam of the type LI-408 were measured. Results show: (1) Pulse beam currents of the vidicon for a value of the effective potential modulator close to zero can, in vidicons with a powerful cathode, attain values of 10 to 20 microamps, and in vidicons with heterotransition screens, reach 10 microamps. (2) The use of static modulation characteristic curves of vidicons for the determination of the pulse beam current can lead to an error greater than 100%. (3) With the help of pulse modulation characteristic curves, it is possible to obtain the dependence of parameters of the vidicons on the beam pulse current and also to make a choice of tube pulse conditions. Author

N73-20235 National Lending Library for Science and Technology, Boston Spa (England).
VOLTAGE SPECTRA OF INVERTERS WITH PULSE WIDTH MODULATION
E. I. Usyshkin Nov. 1972 17 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), v. 1, 1969 p 48-52
(NLL-RTS-7639) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.60; 5 NLL photocopy coupons

The voltage spectra of inverters with pulse width modulation and the application to frequency converters are discussed. The problems associated with electric motor control are analyzed. A numerical analysis is developed in which the spectrum of a nonsinusoidal voltage is represented by a simple Fourier series in which it is convenient to consider all harmonics of increasing order until reaching a harmonic for which the load admittance is negligibly small. Author

N73-20236*# Westinghouse Electric Corp., Lima, Ohio. Aerospace Electronical Div.
DESIGN AND DEVELOPMENT OF A BRUSHLESS, DIRECT DRIVE SOLAR ARRAY REORIENTATION SYSTEM Final Report
R. D. Jessee Apr. 1972 330 p refs
(Contract NAS5-10459)
(NASA-CR-130153) Avail: NTIS HC $18.50 CSCL 09A

This report covers the design and development of the laboratory model, and is essentially a compilation of reports covering the system and its various parts. To enhance completeness, the final report of Phase 1 covering circuit development of the controller is also included. A controller was developed for a brushless, direct-drive, single axis solar array reorientation system for earth-pointed, passively-stabilized spacecraft. A control systems was designed and breadboard circuits were built and tested for performance. The controller is designed to take over automatic control of the array on command after the spacecraft is stabilized in orbit. The controller will orient the solar array to the sun vector and automatically track to maintain proper orientation. So long as the orbit is circular, orientation toward the sun is maintained even though the spacecraft goes into the shadow of the earth. Particular attention was given in the design to limit reaction between the array and the spacecraft. Author

N73-20237*# Boeing Co., Seattle, Wash.
L-BAND ORTHOGONAL-MODE CROSSED-SLOT ANTENNA AND VHF CROSSED-LOOP ANTENNA Final Report
Tryggvi Olsson Aug. 1972 122 p Sponsored in part by NASA (Contract DOT-TSC-130; DOT/TSC Proj. R-1021; DOT/TSC Proj. R-2525)
(NASA-CR-130795; D6-60163; DOT-TSC-NASA-72-2) Avail: NTIS HC $8.25 CSCL 09A

A low gain, circularly polarized, L-band antenna; a low gain, linealy polarized, L-band antenna; and a low gain, circularly

polarized, upper hemisphere, VHF satellite communications antenna intended for airborne applications are described. The text includes impedance and antenna radiation pattern data, along with physical description of the construction of the antennas.
Author

N73-20238*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A SYSTEM FOR STABILIZING CABLE PHASE DELAY Patent Application
Philip A. Clements, inventor (to NASA) Filed 31 Jan. 1973 19 p
(Contract NAS7-100)
(NASA-Case-NPO-13138-1; US-Patent-Appl-SN-335201) Avail: NTIS HC $3.00 CSCL 09A

A system for stabilizing the phase delay of signals passing through a pressurizable coaxial cable is disclosed. Signals from an appropriate source at a selected frequency, are sent through the controlled cable from a first cable end to a second cable end which, electrically, is open or heavily mismatched at 100 MHz, thereby reflecting 100 MHz signals back to the first cable end. The phase difference between the reflected-back signals and the signals from the source is detected by a phase detector. The output of the latter is used to control the flow of gas to or from the cable, thereby controlling the cable pressure, which in turn affects the cable phase delays.
NASA

N73-20239*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TERMINATION OF FLAT CONDUCTOR CABLE TO NASA/MSFC PLUGS
W. Angele Oct. 1972 78 p Prepared in cooperation with Hayes Intern. Corp., Huntsville, Ala.
(Contract NAS8-21809)
(NASA-TM-X-64728) Avail: NTIS HC $6.00 CSCL 09A

Data, supplemented with artwork, are presented on the major steps involved with terminating flat conductor cable (FCC) to MSFC's FCC plugs. Cable and shield preparation steps include material cutting, insulation stripping, and plating of exposed conductors. Methods and equipment required to terminate FCC to each of four MSFC plugs are described.
Author

N73-20240*# Martin Marietta Corp., Denver, Colo.
STUDY OF FEASIBILITY OF SOLID-STATE ELECTRIC SWITCH GEAR FOR AIRCRAFT AND SPACECRAFT
E. Buchanan and D. Waddington Mar. 1973 155 p
(Contract NAS3-15824)
(NASA-CR-121140; MCR-72-327) Avail: NTIS HC $9.75 CSCL 09A

The design of a solid-state circuit breaker that can be interconnected to a second breaker to form a transfer switch is presented. The breaker operates on a nominal 270 volt dc circuit and controls power to loads of up to 15 amperes. Automatic overload trip is provided as a function of excess energy measured through the breaker and/or excess current through the breaker. After an overload trip, up to nine preprogrammable attempts to reclose may be tried with programmable delays between each attempt. The breaker or switch is remotely controllable. Test data on performance in the laboratory over temperatures from minus 45 to 100 C are provided. The feasibility of solid-state switch gear has been established.
Author

N73-20241*# Boeing Co., Seattle, Wash.
DEVELOPMENT OF TERMINATION AND UTILIZATION CONCEPTS FOR FLAT CONDUCTOR CABLES. VOLUME 1: DEVELOPMENT OF LOW PROFILE FLAT CONDUCTOR CABLE CONNECTING DEVICE AND PERMANENT SPLICE
Jul. 1972 122 p
(Contract NAS9-12062)
(NASA-CR-128845; D6-40711-1-Vol-1) Avail: NTIS HC $8.25 CSCL 09A

The development of low-profile flat conductor cable (FCC) connecting device and FCC permanent splice methods are discussed. The design goal for the low-profile connecting device was to mate and unmate FCC harness to a typical spacecraft component with a maximum height of 3/8 in. The results indicate that the design, fabrication, and processing of the low-profile connecting device are feasible and practical. Some redesign will be required to achieve the goal of 3/8 in. Also, failures were experienced subsequent to salt spray and humidity exposure. Five different FCC permanent splice methods were considered. Subsequent to evaluation of these five methods, two design concepts were chosen for development tests.
Author

N73-20242*# Boeing Co., Seattle, Wash.
DEVELOPMENT OF TERMINATION AND UTILIZATION CONCEPTS FOR FLAT CONDUCTOR CABLES. VOLUME 2: UTILIZATION OF SMALL GAGE WIRE ROUND CONDUCTOR CABLES
Jul. 1972 67 p
(Contract NAS9-12062)
(NASA-CR-128846; D6-40711-2-Vol-2) Avail: NTIS HC $5.50 CSCL 09A

The practical use of small-gage round wire for electrical wiring in manned air and space vehicle environments is discussed. The investigation consisted on a study of wire construction and candidate wire harness concepts, fabrication of small-gage wire harnesses, and verification of promising configurations by laboratory evaluation. The wire constructions selected for harness fabrication are described. Results of the laboratory evaluation are included.
Author

N73-20243*# Boeing Co., Seattle, Wash.
DEVELOPMENT OF TERMINATION AND UTILIZATION CONCEPTS FOR FLAT CONDUCTOR CABLES. VOLUME 3: COST STUDY COMPARISON, FLAT VERSUS ROUND CONDUCTOR CABLE
Jul. 1972 38 p
(Contract NAS9-12062)
(NASA-CR-128847; D6-40711-3-Vol-3) Avail: NTIS HC $4.00 CSCL 09A

A cost study comparing flat conductor cable (FCC) with small-gage wire (SGW) and conventional round conductor cable (RCC) is presented. This study was based on a vehicle wiring system consisting of 110,000 ft of conventional RCC equally divided between AWG sizes 20, 22, and 24 using MIL-W-81044-type wire and MIL-C-26500 circular connectors. Basic cost data were developed on a similar-sized commercial jet airplane wiring system on a previous company R&D program in which advanced wiring techniques were carried through equivalent installations on an airplane mockup; and on data developed on typical average bundles during this program. Various cost elements included were engineering labor, operations (manufacturing) labor, material costs, and cost impact on payload. Engineering labor includes design, wiring system integration, wiring diagrams and cable assembly drawings, wire installations, and other related supporting functions such as the electronic data processing for the wiring. Operations labor includes mockup, tooling and production planning, fabrication, assembly, installation, and quality control cost impact on payload is the conversion of wiring system weight variations through use of different wiring concepts to program payload benefits in terms of dollars.
Author

N73-20244# Naval Underwater Systems Center, Newport, R.I.
AN ANALYSIS OF SOME FACTORS THAT AFFECT HYDROPHONE SENSITIVITY
John W. Frye and Michael A. Tucchio 2 Nov. 1972 78 p refs
(SF11121302)
(AD-754099; NUSC-TR-4317; CPG-73-0041) Avail: NTIS CSCL 09/1

The report presents a finite-element shell analysis of a hydrophone using the MARTSAM II program in a Univac 1108 computer. In addition to the piezoelectric and elastic properties of the materials, the effects of end-cap geometry and physical properties were considered. Loading was applied as a train of plane waves acting directly on the surface, and no interaction with the surrounding water was considered. Both the theoretical development and formulation of the MARTSAM II program are presented. The analysis indicates that the performance of present-day hydrophones could be readily improved by modifying the geometry and material of end caps to minimize discontinuity stresses and fringing effects at the end-cap/cylinder junction.
Author (GRA)

N73-20245# Radio Corp. of America, Van Nuys, Calif. Advanced Technology Labs., West.
NON-PIEZOELECTRIC SURFACE WAVE CORRELATOR
George D. OClock, Jr. and David A. Gandolfo Nov. 1972 65 p refs
(Contract F30602-72-C-0037)
(AD-754283; RADC-TR-72-300) Avail: NTIS CSCL 09/1

An acoustic surface wave matched filter has been developed which combines a planar ZnO overlay transducer, to generate acoustic surface waves, and a Metallic Oxide Semiconductor Field Effect Transistor (MOSFET) array, to detect the acoustic surface wave energy, providing a technique which will be compatible with MOS/LSI technology. Author (GRA)

N73-20246# Naval Underwater Systems Center, Newport, R.I.
PROPERTIES OF THE BICONICAL ANTENNA
Kurt F. Hafner, Jr. 20 Dec. 1972 51 p refs
(AD-754386; NUSC-TR-4303) Avail: NTIS CSCL 09/5

Expressions are found for the fields produced by transverse magnetic (TM) and transverse electric and magnetic (TEM) modes along a finitely conducting biconical antenna and along a biconical antenna having a glossy dielectric coating. It is shown that antenna losses produce an attenuation of the fields and, because there is a dispersion of the fields along the biconical antenna, that the attenuation is not generally characterized by simple exponentials. A solution is obtained for the fields of the TEM wave along a biconical antenna coated with a dielectric cone of significantly different permittivity from that of the surrounding media. It is shown that the principal effect of dielectric coating is to reduce the wavelength along the antenna. Energy transfer along the biconical antenna is investigated, and the behavior of the fields along the antenna is interpreted. Author (GRA)

N73-20247# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYSIS OF DIFFRACTION CORRECTIONS FOR RECTANGULAR ULTRASONIC RADIATORS IN A RIGID SCREEN
V. P. Andreev and I. G. Mikhailov 10 Jan. 1973 18 p refs Transl. into ENGLISH from Vestn. Leningrad. Univ., Ser. Fiz. Khim. (USSR), no. 4, 1970 p 48-56
(AF Proj. 7351)
(AD-754677; FTD-HT-23-1540-72) Avail: NTIS CSCL 09/1

The paper presents the results of the calculation of diffraction corrections for radiating and receiving transducers of the square shape. Graphs and tables of the average pressure on the receiving transducer as a function of the generalized distance are given. GRA

N73-20248# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ULTRASONIC DEVICES IN MODERN RADIO ELECTRONICS
G. K. Ulyanov 3 Nov. 1972 22 p refs Transl. into ENGLISH of Inst. Aviats. (USSR), no. 64, 1969 p 1-15
(AD-754616; FTD-MT-24-1475-72) Avail: NTIS CSCL 09/1

A classification of ultrasonic devices with respect to operating principle is presented. The functions played by these devices in radio circuits are investigated, and the lower and upper bounds of the frequency range within the limits of which they can be used are indicated (approximately). Each class is separated into groups with respect to structural attributes, type of ultrasonic waves used and other features. All devices, the function of which consists in delaying a signal with low distortion of its shape, are classified as ultrasonic delay lines. Author (GRA)

N73-20249# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Materials Directorate.
MIGRATION OF SILVER THROUGH GOLD PLATING ON ELECTRICAL CONTACTS
Stewart B. Tulloch and Ronald G. Britton 19 Dec. 1972 43 p
(AD-755123; RL-TR-72-19) Avail: NTIS CSCL 09/1

An investigation was conducted to determine the extent and composition of migrated silver that had pervaded the gold plate of electrical connector contact pins. An extensive electron microscopic analysis of the form and shapes of the masses of crystalline silver and silver salt accumulations on the gold surfaces is presented. Comparisons are made between the corroded pins and newly produced nickel flash underplated pins. Author (GRA)

N73-20250# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ON THE DESIGN ON A TOWED ELF H-FIELD ANTENNA
Michael L. Burrows 28 Dec. 1972 96 p refs
(Contract F19628-73-C-0002; AF Proj. 1508A)
(AD-754949; TN-1972-34; ESD-TR-72-355) Avail: NTIS CSCL 09/5

The various noise sources known to be troublesome in a towed ELF H-field antenna are examined theoretically and formulas are presented enabling noise voltages to be predicted from other measurable quantities. The treatment identifies the role played by the various contributing factors such as cable vibration, cable properties, core permeability, geomagnetic field, etc., and so indicates the way in which the noises can be reduced. Comparisons with experimentally measured noise voltages support the theory. Author (GRA)

N73-20251# Electronic Industries Association, Washington, D.C. MIL-F-1 Storage Tube Review Committee.
REVIEW OF MIL-E-1 TEST METHODS FOR CATHODE RAY CHARGE STORAGE TUBES Final Report
Nathan Ehrlich, D. C. Brooke, A. J. Cloutier, P. P. Damon, R. J. Doyle, F. P. Heiman, Max Kerman, W. E. Kirkpatrick, and R. J. Madden Mar. 1972 144 p
(Contract N00039-69-C-1580)
(AD-754139) Avail: NTIS CSCL 09/1

The report contains recommendations for sixteen new test methods and three revised test methods intended for inclusion of MIL-STD-1311 Test Methods for Electron Tubes. Together with six test methods now included in the Standard, these recommendations are believed to define adequately the performance of both electrical and visual output charge storage tubes when appropriately applied to individual MIL-E-1 specification sheets. A description of the methods employed in the development of the recommendations is included along with a technical discussion and an evaluation of the results wherever these latter two were considered necessary. Author (GRA)

N73-20252# Litton Industries, San Carlos, Calif. Electron Tube Div.
RESEARCH TO DEVELOP MICROWAVE ACOUSTIC SURFACE WAVE DELAY LINES Final Report, 1 Feb. 1971 - 31 May 1972
Donald B. Armstrong 26 Jun. 1972 39 p refs
(Contract F19628-71-C-0132; AF Proj. 5635)
(AD-754896; AFCRL-72-0378) Avail: NTIS CSCL 09/1

The report presents the results of work on a contract for research in the design and fabrication of microwave acoustic surface wave delay lines. Delay lines were made using a variety of substrate materials, including lithium niobate, lithium tantalate, bismuth germanium oxide, and quartz, with center frequencies as high as 1130 MHz. Special delay lines were delivered which had transducers that were designed to have specified bandpass characteristics and minimum ripple in the frequency response. In one instance, match to the required shape as close as 0.04 db was obtained for the frequency region within the 3 db bandwidth. The salient features of the optical fabrication process for producing transducers with line widths as small as 0.7 micrometer are included in the description of the delay line fabrication procedure. Author (GRA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N73-20253* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FUNCTION GENERATOR FOR SYNTHESIZING COMPLEX VIBRATION MODE PATTERNS Patent
Eugene C. Naumann and Gideon J. Hagood, Jr., inventors (to NASA) Issued 30 Jan. 1973 3 p Filed 26 May 1971 Supersedes N72-21275 (10 - 12, p 1590)
(NASA-Case-LAR-10310-1; US-Patent-3,714,405; US-Patent-Appl-SN-147103; US-Patent-Class-235-197) Avail: US Patent Office CSCL 09C

A simple highly flexible device for synthesizing complex vibration mode patterns is described. These mode patterns can be used to identify vibration mode data. This device sums selected sine and cosine functions and then plots the sum against a linear function. Official Gazette of the U.S. Patent Office

N73-20254* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A m-ARY LINEAR FEEDBACK SHIFT REGISTER WITH BINARY LOGIC Patent
Marvin Perlman, inventor (to NASA) Issued 27 Feb. 1973 11 p Filed 26 Oct. 1971 Supersedes N72-20236 (10 - 11, p 1449) Sponsored by NASA
(NASA-Case-NPO-11868; US-Patent-3,718,863; US-Patent-Appl-SN-192101; US-Patent-Class-328-37; US-Patent-Class-307-221R; US-Patent-Class-328-61; US-Patent-Class-328-187) Avail: US Patent Office CSCL 09C

A family of m-ary linear feedback shift registers with binary logic is disclosed. Each m-ary linear feedback shift register with binary logic generates a binary representation of a nonbinary recurring sequence, producable with a m-ary linear feedback shift register without binary logic in which m is greater than 2. The state table of a m-ary linear feedback shift register without binary logic, utilizing sum modulo m feedback, is first tubulated for a given initial state. The entries in the state table are coded in binary and the binary entries are used to set the initial states of the stages of a plurality of binary shift registers. A single feedback logic unit is employed which provides a separate feedback binary digit to each binary register as a function of the states of corresponding stages of the binary registers.
Official Gazette of the U.S. Patent Office

N73-20255 National Lending Library for Science and Technology, Boston Spa (England).
SOLUTION OF EQUATIONS OF NONLINEAR CIRCUITS CONSTRUCTED BY THE NODE VOLTAGE METHOD
Marcel Jirina 4 Dec. 1972 14 p Transl. into ENGLISH from Elektrotechnicky Casopis (Senicka), v. 23, no. 1, 1972 p 16-27 (NLL-Trans-2865-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The analysis of a nonlinear circuit with lumped parameters in the time domain, leading toward the solution of a system of equations is dealt with. Under certain topological and other conditions there exists a unique solution. A more detailed analysis is also made of the physical properties in several cases when the uniqueness is not guaranteed. Author

N73-20256*# Auburn Univ., Ala. Digital Systems Lab.
SURVEY OF DIGITAL FILTERING Final Technical Report, 17 Jun. 1965 - 15 Oct. 1972
H. Troy Nagle, Jr. Oct. 1972 411 p refs
(Contract NAS8-20163)
(NASA-CR-124166) Avail: NTIS HC $22.75 CSCL 09C

A three part survey is made of the state-of-the-art in digital filtering. Part one presents background material including sampled data transformations and the discrete Fourier transform. Part two, digital filter theory, gives an in-depth coverage of filter categories, transfer function synthesis, quantization and other nonlinear errors, filter structures and computer aided design. Part three presents hardware mechanization techniques. Implementations by general purpose, mini-, and special-purpose computers are presented. Author

N73-20257*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MICROWAVE POWER TRANSMISSION SYSTEM Patent Application
William J. Robinson, inventor (to NASA) Filed 13 Mar. 1973 12 p
(NASA-Case-MFS-21470-1; US-Patent-Appl-SN-240871) Avail: NTIS HC $3.00 CSCL 09C

A microwave, wireless, power transmission system is presented in which the transmitted power level is adjusted to correspond with power required at a remote receiving station in which deviations in power load produce an antenna impedance mismatch causing variations in energy reflected by the power receiving antenna at the receiving station. The variations in reflected energy are sensed by a receiving antenna at the transmitting station and used to control the output power of the transmitter. NASA

N73-20258*# Stanford Research Inst., Menlo Park, Calif. Electromagnetic Techniques Lab.
AVALANCHE-DIODE OSCILLATOR CIRCUIT WITH TUNING AT MULTIPLE FREQUENCIES Final Report, 4 Dec. 1969 - 4 Dec. 1970
Don Parker, Clarence M. Ablow, Robert E. Lee, Arthur Karp, and Donald R. Chambers Feb. 1971 143 p refs
(Contracts NAS12-2231; DOT-TSC-6; SRI Proj. 8327)
(NASA-CR-131399) Avail: NTIS HC $9.45 CSCL 09C

Detailed theoretical analysis of three different modes or types of high efficiency oscillation in a PIN diode are presented. For the TRAPATT mode in a PIN diode, it is shown that a traveling avalanche zone is not necessary to generate a dense trapped plasma. An economical computer program for TRAPATT oscillations in a PIN diode is described. Typical results of diode power, dc-to-RF conversion efficiency, and required circuit impedances are presented for several different current waveforms. A semianalytical solution for a second type of high efficiency mode in a PIN diode is derived assuming a rectangular current waveform. A quasi-static approximation is employed to derive a semianalytical solution for the voltage across a PIN diode in a third mode, where avalanching occurs during a major portion of a half cycle. Calculations for this mode indicate that the power increases proportionally to the magnitude of the drive current with a small decrease in efficiency relative to the ordinary TRAPATT mode. An analytical solution is also given for a PIN diode, where it is assumed that the ionization coefficient is a step function. It is shown that the step-ionization approximation permits one to draw possible patterns of avalanche region in the depletion layer as a function of time. A rule governing admissible patterns is derived and an example solution given for one admissible pattern. Preliminary experimental results on the high-efficiency oscillations are presented and discussed. Two different experimental circuits, which used channel-dropping filters to provide independent harmonic tuning, are described. Simpler circuits used to produce high-efficiency oscillations are discussed. Results of experiments using inexpensive Fairchild FD300 diodes are given. Author

N73-20259*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HEAT DETECTION AND COMPOSITIONS AND DEVICES THEREFOR Patent Application
Alan Rembaum, inventor (to NASA) Filed 25 Jun. 1969 24 p
(Contract NAS7-100)
(NASA-Case-NPO-10764-2; US-Patent-Appl-SN-836280) Avail: NTIS HC $3.25 CSCL 09C

Temperature change of a substrate such as a microelectronic component is sensed and detected by means of a mixture of a weak molecular complex of an electron donor compound such as an organic amine and an electron acceptor compound such as nitroaromatic compound. The mixture is encapsulated in a clear binder such as a vinyl resin. NASA

N73-20260*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
STABILITY OF UNCERTAIN SYSTEMS Ph.D. Thesis
Gilmer Leroy Blankenship Jun. 1971 126 p refs
(Grant NGL-22-009-124)
(NASA-CR-131372; ESL-R-448) Avail: NTIS HC $8.50 CSCL 09C

The asymptotic properties of feedback systems are discussed, containing uncertain parameters and subjected to stochastic perturbations. The approach is functional analytic in flavor and thereby avoids the use of Markov techniques and auxiliary Lyapunov functionals characteristic of the existing work in this area. The results are given for the probability distributions of the accessible signals in the system and are proved using the Prohorov theory of the convergence of measures. For general nonlinear systems, a result similar to the small loop-gain theorem of deterministic stability theory is given. Boundedness is a property of the induced distributions of the signals and not the usual notion of boundedness in norm. For the special class of feedback systems formed by the cascade of a white noise, a sector nonlinearity and convolution operator conditions are given to

insure the total boundedness of the overall feedback system.
Author

N73-20261*# Virginia Univ., Charlottesville. Div. of Aerospace Engineering and Engineering Physics.
PERFORMANCE EVALUATION CAPABILITIES FOR THE DESIGN OF PHYSICAL SYSTEMS Final Report
Walter D. Pilkey and B. P. Wang Sep. 1972 25 p refs
(Grant NGR-47-005-145)
(NASA-CR-112293; AEEP-4085-107-72U) Avail: NTIS HC $3.25 CSCL 12B

The results are presented of a study aimed at developing and formulating a capability for the limiting performance of large steady state systems. The accomplishments reported include: (1) development of a theory of limiting performance of large systems subject to steady state inputs; (2) application and modification of PERFORM, the computational capability for the limiting performance of systems with transient inputs; and (3) demonstration that use of an inherently smooth control force for a limiting performance calculation improves the system identification phase of the design process for physical systems subjected to transient loading.
Author

N73-20262# Naval Air Systems Command, Washington, D.C.
ELECTROMAGNETIC COMPATIBILITY MANUAL. APPENDIX A THROUGH APPENDIX G.
May 1972 483 p refs
(AD-754412; NAVAIR-5335-App) Avail: NTIS CSCL 09/3

The following topics are discussed: Electromagnetic compatibility control plan for XY-1A Weapon System; Electromagnetic interference control plan for data link subsystem; XY-2A aircraft weapon system electromagnetic compatibility test plan; Electromagnetic interference test plan; Glossary, designators, and abbreviations; Computational aids.
GRA

N73-20263# Naval Air Systems Command, Washington, D.C.
ELECTROMAGNETIC COMPATIBILITY MANUAL
Joseph J. Fisher May 1972 829 p refs
(AD-754411; NAVAIR-5335) Avail: NTIS CSCL 09/3

The material in the manual, with its contributions for improvements in the state-of-the-art of electromagnetic compatibility, provides a reference on methods for the reduction of electromagnetic interference and accomplishing electromagnetic compatibility in and between aircraft weapons systems.
Author (GRA)

N73-20264# Ohio Univ., Athens. Dept. of Electrical Engineering.
FAULT DETECTION AND DIAGNOSIS IN COMBINATIONAL CIRCUITS
Bhakta Kumar Roy Nov. 1972 179 p refs
(Contracts DAAB07-68-C-0084; DAAB07-71-C-0156)
(AD-754029; EER-16-17; ECOM-0084-S-3) Avail: NTIS CSCL 09/5

Two approaches to detection and diagnosis of single-gate failures are presented. One is an algebraic approach which derives minimal test sets by iterative intersections of higher dimensional cubes representing tests and the other is a tabular method that requires use of diagnostic tables. A diagnostic table lists gate sensitivities and network primary output values, with and without the failures present, for all possible inputs to the network. This information is used to locate a faulty gate and describe its failed function. Techniques for deriving minimal test sets and adaptive test schedules from diagnostic tables are also derived. The application of diagnostic tables to the deprivation of equivalence classes of faults in combinational networks is presented. A synthesis technique using diagnostic tables is also derived. The problem of diagnosable synthesis of combinational nets is considered.
Author (GRA)

N73-20265# Stanford Research Inst., Menlo Park, Calif.
TRANSMISSION LINE MODELS FOR USE WITH COMPUTER-AIDED CIRCUIT ANALYSIS CODES Technical Report, 27 Oct. 1971 - 27 Oct. 1972
M. Lattimer Wright and Leonard S. Gasidrek Dec. 1972 155 p refs Sponsored in part by DNA
(Contract F29601-72-C-0019; AF Proj. 5710; SRI Proj. 1552)
(AD-754964; AFWL-TR-72-178) Avail: NTIS CSCL 09/1

A model was developed for the class of n-conductor transmission lines for use with the SCEPTRE computer program. The model will reproduce the normal electrical performance of the line and is amenable to modifications that will reproduce the effects of an environment of ionizing, EMP, and neutron radiation. The model is based on the fact that wave propagation on a multiconductor cable can be characterized by orthogonal, independent modes. Each of these modes can then be modeled as a single, independent transmission line. These lines, representing the modes, are connected to terminal-to-mode and mode-to-terminal converters at each end of the line. Thus, the overall model represents the terminal-to-terminal electrical behavior of an actual n-conductor cable. The model was verified by comparing the computer-calculated and experimentally measured responses of a three-conductor, two-transmission-line structure. The report includes a CDC 6600 FORTRAN computer program to reduce the measurement data required to derive the model parameters.
Author (GRA)

N73-20266# Ohio Univ., Athens. Dept. of Electrical Engineering.
PRACTICAL DIGITAL FILTER DESIGN
Patrick H. Garrett Oct. 1972 37 p refs
(Contract DAAB07-68-C-0084)
(AD-754032; EER-16-15; ECOM-0084-S-6) Avail: NTIS CSCL 09/5

Review of Fourier, Laplace and Z-transforms provides introduction to discrete time systems. The RC low-pass filter is modeled in terms of a feedback structure and compared with its analogy to recursive low-pass digital filters. These topics introduce the preferred transversal digital filter for low-pass and band-pass applications. An efficient method of synthesizing transversal filters is demonstrated from the derivation of Fourier coefficients and time delays. A method of weighting the truncated Fourier terms by Hamming coefficients to suppress Gibb's oscillation is also shown. Design examples demonstrating the magnitude and phase response of low-pass and band-pass transversal filters are presented.
Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N73-20267* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TEST STAND SYSTEM FOR VACUUM CHAMBERS Patent
Dewey F. Newman, inventor (to NASA) Issued 6 Feb. 1973 5 p Filed 23 Dec. 1971 Supersedes N72-20252 (10 - 11, p 1452)
(NASA-Case-MFS-21362; US-Patent-3,714,833; US-Patent-Appl-SN-211411; US-Patent-Class-73-432SD) Avail: US Patent Office CSCL 14B

A test stand system for supporting test items in a vacuum chamber is described. The system consists of a frame adapted to conform to the inside of the vacuum chamber and supporting a central vertical shaft. The shaft rotates on bearings located at each end of the shaft. Several vertically spaced plates which fixed to the vertical shaft may be adjusted for height to support the test equipment as required. The test equipment may be rotated during tests without disturbing the vacuum by a manually actuated drive external to the vacuum chamber.
Official Gazette of the U.S. Patent Office

N73-20268*# PRC Systems Sciences Co., Los Angeles, Calif.
DEVELOPMENT OF KSC PROGRAM FOR INVESTIGATING AND GENERATING FIELD FAILURE RATES. VOLUME 2: RECOMMENDED FORMAT FOR RELIABILITY HANDBOOK FOR GROUND SUPPORT EQUIPMENT Final Report
Charles E. Bloomquist and Richard H. Kallmeyer 24 May 1972 394 p refs
(Contract NAS10-7621)
(NASA-CR-131362; PRC-R-1459-Vol-2) Avail: NTIS HC

$21.75 CSCL 14D

Field failure rates and confidence factors are presented for 88 identifiable components of the ground support equipment at the John F. Kennedy Space Center. For most of these, supplementary information regarding failure mode and cause is tabulated. Complete reliability assessments are included for three systems, eight subsystems, and nine generic piece-part classifications. Procedures for updating or augmenting the reliability results presented in this handbook are also included. Author

N73-20269# Advisory Group for Aerospace Research and Development, Paris (France). Large Wind Tunnels Working Group.
THE NEED FOR LARGE WIND TUNNELS IN EUROPE
Dec. 1972 98 p refs
(AGARD-AR-60) Avail: NTIS HC $7.00

The Report of the Large Wind-Tunnels Working Group of the AGARD Fluid Dynamics Panels, follows nine meetings between December 1971 and November 1972. Review of existing position and future prospects, the role of the wind-tunnel in research and development, existing European wind-tunnels present national plans for wind-tunnels, future needs, options for new large low-speed and transonic tunnels, a proposed time schedule for provision of new tunnels, and proposals for a collaborative work program to clarify existing problems in wind-tunnel design and operation. It is concluded that the first priority is for a new large pressurized transonic wind-tunnel in Europe; four possible options for realization of this need are given, and an Engineering Study is proposed, with a Work Statement, to assess and evaluate the engineering requirements of the options. The second priority, of importance almost equal to the first, is for a new large low-speed wind-tunnel. This should be of 18 m or 25 m width; the Group has not been able to agree between these figures. Provision of new European supersonic and hypersonic facilities should begin when the subsonic and transonic requirements have been met; long term technical needs for these are defined. Author

N73-20270*# Singer Co., Binghamton, N.Y. Simulation Products Div.
SHUTTLE MISSION SIMULATOR SOFTWARE CONCEPTUAL DESIGN
J. F. Burke 23 Mar. 1973 710 p
(Contract NAS9-12836)
(NASA-CR-128882) Avail: NTIS HC $37.50 CSCL 14B

Software conceptual designs (SCD) are presented for meeting the simulator requirements for the shuttle missions. The major areas of the SCD discussed include: malfunction insertion, flight software, applications software, systems software, and computer complex. F.O.S.

N73-20271# Federal Aviation Administration, Washington, D.C.
AIRPORT DESIGN STANDARDS: EFFECTS AND TREATMENT OF JET BLAST
13 Jul. 1972 18 p refs
(AC-150/5325-6A) Avail: NTIS HC $3.00

Criteria on the jet engine blast velocities associated with aircraft in common use in air carrier service, the effects of these blast velocities during ground operations, and suggested methods for counteracting or minimizing the effects are presented. The areas considered are: (1) personnel and equipment operation, (2) taxiways, (3) pavement edge, (4) cargo and maintenance areas, and (5) terminal areas. Graphs of blast velocities for various aircraft at different stages of operation are developed. The design and installation of blast fences are analyzed. The effects of blast erosion on off-pavement areas are reported. Author

N73-20272*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 16 MISSION ANOMALY REPORT NO. 9: LUNAR ROVING VEHICLE ELECTRICAL SYSTEM METER ANOMALIES
Jan. 1973 7 p
(NASA-TM-X-69123; MSC-07684) Avail: NTIS HC $3.00 CSCL 14D

The off-scale low indications of the voltmeters for batteries one and two at initial powerup of the Apollo 16 lunar roving vehicle were analyzed. No single condition was found that would explain the anomalous meter indications. It is concluded that the intermittent conditions must have existed in the multiple wire splices to the meters. F.O.S.

N73-20273*# TRW Systems Group, Redondo Beach, Calif.
DEFINITION OF EXPERIMENTS AND INSTRUMENTS FOR A COMMUNICATION/NAVIGATION RESEARCH LABORATORY. VOLUME 1: EXECUTIVE SUMMARY
Dec. 1972 49 p refs 4 Vol.
(Contract NAS8-27540)
(NASA-CR-124136; TRW-20405-6001-R0-81-Vol-1) Avail: NTIS HC $4.50 CSCL 14B

This study was undertaken to develop conceptual designs for a manned, space shuttle sortie mission laboratory capable of supporting a wide variety of experiments in conjunction with communications and navigation research. This space/laboratory would be one in which man may effectively increase experiment efficiency by certain observations, modifications, setup, calibration, and limited maintenance steps. In addition, man may monitor experiment progress and perform preliminary data evaluation to verify proper equipment functioning and may terminate or redirect experiments to obtain the most desirable end results. The flexibility and unique capabilities of man as an experimenter in such a laboratory will add greatly to the simplification of space experiments and this provides the basis for commonality in many of the supportive subsystems, thus reaping the benefits of reusability and reduced experiment costs. Author

N73-20274*# TRW Systems Group, Redondo Beach, Calif.
DEFINITION OF EXPERIMENTS AND INSTRUMENTS FOR A COMMUNICATION/NAVIGATION RESEARCH LABORATORY. VOLUME 2: EXPERIMENT SELECTION
May 1972 543 p refs 4 Vol.
(Contract NAS8-27540)
(NASA-CR-124137; TRW-20405-6001-R0-81-Vol-2) Avail: NTIS HC $29.25 CSCL 14B

The selection and definition of candidate experiments and the associated experiment instrumentation requirements are described. Information is presented that addresses the following study objectives: (1) determine specific research and technology needs in the comm/nav field through a survey of the scientific/technical community; (2) develop manned low earth orbit space screening criteria and compile lists of potential candidate experiments; (3) in Blue Book format, define and describe selected candidate experiments in sufficient detail to develop laboratory configuration designs and layouts; and (4) develop experiment time phasing criteria and recommend a payload for sortie can/early laboratory missions. Author

N73-20275*# TRW Systems Group, Redondo Beach, Calif.
DEFINITION OF EXPERIMENTS AND INSTRUMENTS FOR A COMMUNICATION/NAVIGATION RESEARCH LABORATORY. VOLUME 3: LABORATORY DESCRIPTIONS
Jul. 1972 288 p refs
(Contract NAS8-27540)
(NASA-CR-124138; TRW-20405-6001-R0-81-Vol-3) Avail: NTIS HC $16.50 CSCL 14B

The following study objectives are covered: (1) identification of major laboratory equipment; (2) systems and operations analysis in support of the laboratory design; and (3) conceptual design of the comm/nav research laboratory. For Vol. 4, see N73-19268. Author

N73-20276*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH PRESSURE OXYGEN UTILIZATION BY NASA
Frank E. Belles Mar. 1973 18 p refs Presented at 74th Natl. Meeting of the Am. Inst. of Chem. Engr., New Orleans, 11-15 Mar. 1973
(NASA-TM-X-68203) Avail: NTIS HC $3.00 CSCL 22D

Although NASA is not one of the country's major oxygen consumers, it uses oxygen under severe conditions including very high flow rates and pressure. Materials for such applications must be carefully selected for compatibility, because susceptibility to ignition increases as operating pressure is raised. Much work is needed, however to define the selection criteria. Some of the work in this area that is being performed under sponsorship of NASA's Aerospace Safety Research and Data Institute (ASRDI) is described. Author

N73-20277*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
AEROACOUSTIC RESEARCH IN WIND TUNNELS: A STATUS REPORT
James Bender and R. E. A. Arndt Feb. 1973 163 p refs
(Contract NAS2-6312)
(NASA-CR-114575; PSU-AERSP-73-1) Avail: NTIS HC $10.25 CSCL 14B

The increasing attention given to aerodynamically generated noise brings into focus the need for quality experimental research in this area. To meet this need several specialized anechoic wind tunnels have been constructed. In many cases, however, budgetary constraints and the like make it desirable to use conventional wind tunnels for this work. Three basic problems are inherent in conventional facilities: (1) high background noise, (2) strong frequency dependent reverberation effects, and (3) unique instrumentation problems. The known acoustic characteristics of several conventional wind tunnels are evaluated and data obtained in a smaller 4- x 5-foot wind tunnel which is convertible from a closed jet to an open jet mode are presented. The data from these tunnels serve as a guideline for proposed modifications to a 7- x 10-foot wind tunnel. Consideration is given to acoustic treatment in several different portions of the wind tunnel. Author

N73-20278# Systems Consultants, Inc., McLean, Va. Management and Data Systems Div.
STATISTICAL METHOD FOR MEASURING AERONAUTICAL ACTIVITY AT NONTOWERED AIRPORTS Final Report, Dec. 1971 - Jul. 1972
Bruce Brown and Carl Carlson Jan. 1973 96 p
(Contract DOT-FA72WA-2774)
(SCI-2040; FAA-RD-73-18) Avail: NTIS HC $7.00

A study to evaluate existing procedures for estimating annual operations at non-tower airports develop new alternative methods with equal or superior qualifications and present necessary comparison data concerning statistical accuracy and cost to permit the FAA to select a standardized technique to be used throughout the country is reported. For this purpose an analytical procedure was developed which evaluated both existing and new alternative techniques by comparing their predictive qualities with a set of known operations data representative of airports in each region of the United States. The principal results, the basis of the analysis, documentation of comparative studies and identification of recommended alternative estimation techniques are included. The statistical foundations of each estimating technique have been rigorously examined in this study and these efforts are thoroughly documented. Author

N73-20279*# Virginia Univ., Charlottesville.
EVALUATION OF AERODYNAMIC DERIVATIVES FROM A MAGNETIC BALANCE SYSTEM
Boray S. Raghunath and Hermon M. Parker [1972] 33 p refs
(Grant NGR-47-005-029)
(NASA-CR-112305) Avail: NTIS HC $3.75 CSCL 14B

The dynamic testing of a model in the University of Virginia cold magnetic balance wind-tunnel facility is expected to consist of measurements of the balance forces and moments, and the observation of the essentially six degree of freedom motion of the model. The aerodynamic derivatives of the model are to be evaluated from these observations. The basic feasibility of extracting aerodynamic information from the observation of a model which is executing transient, complex, multidegree-of-freedom motion is demonstrated. It is considered significant that, though the problem treated here involves only linear aerodynamics, the methods used are capable of handling a very large class of aerodynamic nonlinearities. The basic considerations include the effect of noise in the data on the accuracy of the extracted information. Relationships between noise level and the accuracy of the evaluated aerodynamic derivatives are presented. Author

N73-20280# Saphier, Lerner, Schindler, Environetics, Inc., New York.
NEW YORK OFFSHORE AIRPORT FEASIBILITY STUDY
Lawrence Lerner and Marshall A. Graham Washington FAA Mar. 1973 31 p
(Contract DOT-FA71WA-2626)
(FAA-RD-73-45) Avail: NTIS HC $3.50

The technical and economic feasibility of an offshore airport for the New York Metropolitan region are discussed. The study included analyses of a series of major tasks and subtasks which affect airport planning including: (1) air traffic projections, (2) air traffic control, (3) meteorology, airport design and layout, (4) oceanographic and geologic factors, (5) facilities engineering and construction (with particular emphasis on the special factors due to the site on water), (6) ground access systems, and (7) environmental factors such as marine ecology, noise and air pollution, solid waste disposal and radioactivity. A multimodal concept was considered including a deep-draft harbor at the selected location. Review of these program areas led to the conclusion that the selected site should be south of the barrier beaches of Long Island and that the development of this offshore airport is feasible. Author

N73-20281# Joint Publications Research Service, Arlington, Va.
GEOGRAPHY OF SCIENCE - PAST AND PRESENT
Ye. A. Belyayev 28 Mar. 1973 8 p refs Transl. into ENGLISH from Priroda (Moscow), no. 8, 1972 p 91-93
(JPRS-58596) Avail: NTIS HC $3.00

Information is provided on the development of scientific centers in the U.S.S.R. during the past 50 years and the important considerations for future development. Author

N73-20282# Joint Publications Research Service, Washington, D.C.
STUDY OF DENSITY FLUCTUATIONS OF THE L-I STELLARATOR BY THE CORRELATION METHOD
M. S. Berezhetskii, S. E. Grebenshchikov, I. A. Kossyi, I. S. Sbitnikova, and I. S. Shpigel Nov. 1972 27 p refs Transl. into ENGLISH from Russian report NP-19257 Prepared for AEC
(AEC-tr-7376; NP-19257) Avail: NTIS

The spectral and space-time characteristics of the density and electric field fluctuations and also their dependences on the magnitude of the magnetic field intensity and the angle of rotational transformation of the lines of force were studied. Determination of the indicated characteristics of force were studied. Determination of the indicated characteristics of the fluctuations combined with knowledge of the basic plasma parameters permitted identification of the type of excited oscillations on the basis of the existing theoretical concepts and indication of the possible buildup mechanisms and the effects leading to stabilization. NSA

N73-20283# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Materials Directorate.
GROUND SUPPORT EQUIPMENT AIRBORNE LAUNCHER VIBRATION ISOLATION DESIGN
James M. Oliver 6 Sep. 1972 46 p refs
(DA Proj. 1M2-62303-A-214)
(AD-754537; RL-TR-72-9) Avail: NTIS CSCL 19/5

A theoretical analysis of simple mathematical models of mechanical systems is carried out with a view toward the design of a vibration isolation system for helicopter mounted rocket launchers. Possible future problems and their possible solutions are discussed. An alternative to the vibration isolation system as a means of reducing launching errors due to helicopter induced motion is given. Author (GRA)

N73-20284# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
TEST PLAN TO SUBSTANTIATE THE CAPACITY OF E-2A ARRESTED LANDINGS
Robert B. Cadman 7 Nov. 1972 9 p refs
(AD-754752; NADC-72216-VT) Avail: NTIS CSCL 01/5

The E-2A arresting hook A-frame is currently adequate for 500 arrested landings. It is the purpose of this effort to extend the life to 3,000 arrested landings. Author (GRA)

N73-20285# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
HOOK BOUNCE TEST OF THE E-2A AIRPLANE A-FRAME Final Report
Robert B. Cadman 27 Dec. 1972 14 p

(AD-754753; NADC-72218-VT) Avail: NTIS CSCL 01/5

A laboratory hook bounce test was performed on an E-2A arresting gear A-frame to determine whether the A-frame could sustain the effects of 3000 arrested landings. A total of 6000 simulated hook bounce cycles were applied to the A-frame during the test with no structural failures. With a test scatter factor of 2, the 6000 test cycles are equivalent to 3000 service arrested landings. Author (GRA)

N73-20286# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.

RESEARCH ON NOISE GENERATED BY DUCTED AIR-FUEL COMBUSTION SYSTEMS Annual Report, 1 Mar. 1971 - 29 Feb. 1972

Edelbert G. Plett and Martin Summerfield 1 Mar. 1972 45 p refs

(Contract N00014-67-A-0151-0029)

(AD-754094) Avail: NTIS CSCL 14/2

The development of a jet noise facility to study the interaction of the flow with bluff bodies inside the duct resulting in more intense noise than is expected from the jet itself is described. The long range objective is to use the information on noise due to bluff bodies and non-steady combustion inside the duct to relate their relative importance as a source of noise in an aircraft jet engine. The construction of the flow system and anechoic chamber is described. An analytical model is developed which incorporates sources of noise both inside and outside the engine. Author (GRA)

N73-20287# Naval Postgraduate School, Monterey, Calif.

A DESCRIPTION OF THE TURBOPROPULSION LABORATORY IN THE AERONAUTICS DEPARTMENT AT THE NAVAL POSTGRADUATE SCHOOL

Michael H. Vavra and Raymond P. Shreeve Sep. 1972 46 p refs

(AD-754380; NPS-57VA72091A) Avail: NTIS CSCL 14/2

Extensive facilities have been developed at the Naval Postgraduate School for teaching and research in turbomachinery. In eight years of growth, more than 30 Naval officers have completed theses toward advanced engineering degrees. The report briefly describes the existing equipment and mentions examples of research both completed and underway. Particular details can be obtained from the listed references. The purpose of the report is to provide a convenient reference for present and prospective students and to satisfy inquiries from sources external to the School. Author (GRA)

N73-20288# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.

HOOK BOUNCE TEST OF THE C-2A AIRPLANE ARRESTING GEAR A-FRAME Final Report

R. B. Cadman 27 Nov. 1972 13 p

(AD-754077; NADC-72217-VT) Avail: NTIS CSCL 01/5

A laboratory hook bounce test was performed on a C-2A arresting gear A-frame to determine whether the A-frame could sustain the effects of 3,000 arrested landings. A total of 6,000 simulated hook bounce cycles were applied to the A-frame during the test with no structural failures. With a test scatter factor of 2, the 6,000 test cycles are equivalent to 3,000 service arrested landings. Author (GRA)

N73-20289# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.

TEST PLAN TO SUBSTANTIATE THE CAPACITY OF THE C-2A ARRESTING HOOK A-FRAME TO SUSTAIN 3,000 ARRESTED LANDINGS

Robert B. Cadman 15 Sep. 1972 10 p refs

(AD-754076; NADC-72178-VT) Avail: NTIS CSCL 01/5

The C-2A arresting hook A-frame is currently adequate for 500 arrested landings. It is the purpose of this effort to extend the life to 3,000 arrested landings. Author (GRA)

N73-20290# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.

CONSTRUCTION OF A 200 kV ION ACCELERATOR Interim Technical Report

Dennis D. Edwall Dec. 1972 69 p refs

(Contract F30602-71-C-0110)

(AD-754274; RADC-TR-72-306) Avail: NTIS CSCL 20/7

Philosophy of design and details of construction of a relatively inexpensive yet flexible and simple to use 200 kV heavy ion accelerator are described. The vacuum systems, high voltage power supplies, multiple-sample target chamber, and ion source are presented in a form suitable for the guidance of others who may wish to construct a similar machine. Author (GRA)

N73-20291# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

QUESTION OF ION ACCELERATION BY THE ELECTRON RING IN A DECREASING MAGNETIC FIELD

I. N. Ivanov, E. A. Perelshtein, and V. P. Sarantsev 22 Sep. 1972 15 p Transl. into ENGLISH of JINR, Dubna, USSR report 1970 p 1-11

(AD-753968; FTD-MT-24-1091-72) Avail: NTIS CSCL 20/7

The problem of keeping the ions in the potential well of the electron ring when accelerating it in the decreasing magnetic field is considered. Author (GRA)

N73-20292# Naval Ordnance Lab., White Oak, Md.

[RESEARCH PROGRESS IN AERODYNAMICS, BALLISTICS, MATHEMATICS, CHEMISTRY, AND EXPLOSIVES. INDEPENDENT RESEARCH, 1972] Research Report, 1 Jul. 1971 - 1 Jul. 1972

D. F. Bleil 1 Jul. 1972 131 p refs

(ZR00001-010)

(AD-754397; NOLR-1290) Avail: NTIS CSCL 14/2

The report gives an up-to-date account of active independent research tasks. These tasks fall into the following categories: solid state physics, metallurgy, electromagnetic interaction with atoms and molecules, intense radiation, smoke and fire, field theory, elementary particles, liquid state, superconductivity, applied mathematics and computer sciences, fluid flow theory, thermodynamics of high temperatures, high-speed gas flows, earth re-entry body problems, explosive chemistry, deflagration to detonation, properties of solids under explosive loading, chemistry of high energy compounds, nuclear chemistry, and electrochemistry for power sources. Author (GRA)

N73-20293# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE COLLECTIVE ACCELERATION OF IONS

I. N. Ivanov, A. B. Kuznetsov, E. A. Parelshtein, V. A. Preizendorf, and K. A. Resj Reshetnikov 12 Jan. 1973 88 p refs Transl. into ENGLISH from Probl. Fiz. Elementarnykh Chastits i At. Yadra (USSR), v. 1, no. 2, 1971 p 391-442

(AD-754624; FTD-MT-24-1648-72) Avail: NTIS CSCL 20/7

The collective method for acceleration of ions is described. The problem of the formation of an electron ring cluster charged with ions, its stability and focusing, and some questions of acceleration are discussed. Author (GRA)

N73-20294# Martin Marietta Corp., Orlando, Fla.

RELATIVE EFFECTIVENESS OF TWO AND THREE DIMENSIONAL IMAGE STORAGE MEDIA Final Report, Jun. 1970 - Feb. 1972

Barry C. King and Frank D. Fowler Sep. 1972 122 p refs

(Contract N61339-70-C-0238)

(AD-754743; OR-11796; NAVTRAEQUIPCEN-70-C-0238-1) Avail: NTIS CSCL 05/9

Experiments were conducted to evaluate subjects' ability to perceive the dimensionality of source material used to generate a dynamic TV image of simulated military targets. The Dive Approach test series investigated the perception of motion-dependent depth cures during an approach to the target area at a constant dive angle. The stimulus material used in these behavioral tests were video recordings of runs using 3-dimensional and optically simulated 2-dimensional target areas. Results show how movement parallax normally provides useful depth cures only at very close ranges, both for constant dive angle and constant altitude approach geometries. The finding has significant implications for the design of visual simulation equipment to be used for training. Author (GRA)

N73-20295# Center for Naval Analyses, Arlington, Va. Systems Evaluation Group.

THE UTILITY OF HIGH PERFORMANCE WATERCRAFT FOR

SELECTED MISSIONS OF THE UNITED STATES COAST GUARD Final Report
Thaddeus R. Mitchell, Lawrence S. Cohan, and Charles H. Heider 22 Nov. 1972 307 p refs
(Contract DOT-CG-21941-A)
(AD-754917; SEG-Study-13) Avail: NTIS CSCL 13/10

The report examines the effectiveness and cost of high performance watercraft used in three specific missions of the U.S. Coast Guard: Search and Rescue (SAR); Aids to Navigation on the Western Rivers; and Marine Fisheries Law Enforcement. An historical SAR data base is analyzed and the inclusion of air cushion vehicles (ACV's) in the SAR force mix is examined. The utility of ACV's and faster conventional river tenders on the Western Rivers is analyzed. A hydrofoil is compared with conventional Coast Guard cutters and patrol boats for use in the marine fisheries law enforcement mission. Author (GRA)

N73-20296# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
TRANSPORTATION IN THE ARCTIC
F. C. Paddison and A. M. Stone Apr. 1972 101 p refs
(Contract N00017-72-C-4401)
(AD-754381; APL-TG-1190) Avail: NTIS CSCL 13/6

There is no year-round transportation in the Arctic. Year-round roads and railroads and high-bearing-load air fields to accommodate today's heavy-lift cargo aircraft could be built to the edge of the broad Arctic Ocean, if military necessity or potential resource development warranted it. Shallow-draft barges and boats will continue to be used to transport bulk cargo during the brief season around the perimeter of the Arctic Ocean. Large, very powerful icebreaker cargo ships for transport through the Arctic Ocean ice mantle are feasible and have been demonstrated; however, docking, loading, and general operational problems must be solved. Travel across the Arctic Ocean ice mantle with a truly amphibious craft, the Surface Effect Vehicle (SEV) currently under development will eventually provide long range year-round transportation over the Arctic Ocean's permanent ice cover. The SEV with low footprint pressures can travel not only over the pressure ridged rubble fields of the pack ice, but also over the tender summer tundra without subsequent effect. The report discusses all the above points and, in addition, briefly reviews the history of exploration of the Arctic. The extent of Arctic ground and air transportation facilities in the USSR, USA, Canada, Greenland, Iceland, and Scandinavia is shown. The Arctic Ocean icebreaker cargo ship is discussed, as is the search and rescue problem. Arctic air, ground, and marine techniques are summarized, and the Arctic SEV is discussed and the plans for its development outlined. Author (GRA)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N73-20297 National Lending Library for Science and Technology, Boston Spa (England).
CONCERNING THE DIMENSION OF THE CONSTANT OF TURBULENT COAGULATION
V. I. Smirnov Jan. 1973 34 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), v. 71, 1966 p 16-33
(NLL-RTS-7293) Avail: Natl. Lending Library, Boston Spa, Engl.: £3.30; 11 NLL photocopy coupons

The boundaries confining the constant of turbulent coagulation of aerosols have been determined, and the extremity of the length of a relative free run or clear-way has been established. The coverage coefficient of particles is taken as being equal to one unit, while confluence probability, in the event of collision, is arbitrary. It has been shown that coagulation conforms to what practically amounts to a gas kinetic regime, variation in the coagulation's speed being no greater than 15%. Attempts to define the constant of coagulation by kinetic equation entail some complications (paradox of concentration). Author

N73-20298 National Lending Library for Science and Technology, Boston Spa (England).
HYDRO AND AERODYNAMIC PHENOMENA IN LIQUID DIELECTRIC CONDUCTION
N. Felici 10 Nov. 1972 39 p refs Transl. into ENGLISH from Rev. Gen. de l'Elec. (Paris), v. 78, no. 7-8, Jul. 1969 p 717-734
(NLL-PO-2890-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 4 NLL photocopy coupons

The conduction problem is examined arising in a nonself-dissociated liquid dielectric through the injection of charge carriers. Dimensional analysis is used to define hydrodynamic mobility (ratio of liquid velocity to electric field) which leads to undetermined functions. The velocity of the liquid is established and is considerably greater than the ion velocity, and shows that this phenomenon begins very shortly after injection. In liquids, dragging is the main factor in the observed conduction; in gases, its role is negligible which justifies considering a gas traversed by an electric discharge as being immobile. Author

N73-20299 National Lending Library for Science and Technology, Boston Spa (England).
EXPERIMENTAL INVESTIGATIONS ON AXIAL FLOW ANNULAR SLOTS SUCH AS OCCUR IN IMPELLER PUMPS Ph.D. Thesis - Tech. Univ., Brunswick, 1971
D. Weber 4 Dec. 1972 19 p refs Transl. into ENGLISH from Konstruktion (West Berlin), v. 24, no. 6, 1972 p 205-210 In ENGLISH and GERMAN
(NLL-NEL-TT-2422-(6075.461)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Measurements were made of the flow resistances of the slots formed by a smooth-walled stationary outer cylinder and a rotating inner cylinder which may be either smooth-walled or provided with grooves. As a result of the test data, recommendations are given for the groove dimensions. A worked example is given to illustrate the application of the results. Author

N73-20300*# Goodyear Aerospace Corp., Akron, Ohio.
INVESTIGATION OF EXTENDABLE NOZZLE CONCEPTS Final Report
Charles N. Scott, Robert W. Nordlie, and William W. Sowa Nov. 1972 123 p refs
(Contract NAS8-21476)
(NASA-CR-124165; GER-15240) Avail: NTIS HC $8.25 CSCL 20D

Preliminary research and technology were performed toward the development of a transpiration cooled inflatable nozzle extension. The J-2 engine of the Saturn-Apollo launch vehicle was selected as a design application test bed to provide realistic operational parameters and a possible hot firing demonstration. The nozzle extension attached at the 27.5 to 1 area ratio of the basic J-2 nozzle exit and extended to an area ratio of 48 to 1. The final nozzle extension design as evolved during this effort utilized conically woven stainless steel airmat as the major construction material. Model and full scale nozzle extensions were fabricated and tested although an actual J-2 hot firing demonstration was not possible due to the lack of a proper altitude test opportunity. Author

N73-20301*# Tennessee Technological Univ., Cookeville. College of Engineering.
AN INVESTIGATION OF THE OPEN-LOOP AMPLIFICATION OF REYNOLDS NUMBER DEPENDENT PROCESSES BY WAVE DISTORTION Annual Report
Kenneth R. Purdy, Marie B. Ventrice, and Jih-Chin Fang Dec. 1972 63 p refs
(Grant NGR-43-003-015)
(NASA-CR-121167) Avail: NTIS HC $5.25 CSCL 20D

Analytical and experimental studies were initiated to determine if the response of a constant temperature hot wire anemometer to acoustic oscillations could serve as an analog to the response of the drop vaporization burning rate process to acoustic oscillations, and, perhaps, also as an analog to any Reynolds number dependent process. The motivation behind this study was a recent analytical study which showed that distorted acoustic oscillations could amplify the open-loop response of vaporization limited combustion. This type of amplification may be the cause of unstable combustion in liquid propellant rocket

engines. The analytical results obtained for the constant temperature anemometer are similar in nature to those previously obtained for vaporization limited combustion and indicate that the response is dependent on the amount and type of distortion as well as other factors, such as sound pressure level, Mach number and hot wire temperature. Preliminary results indicate qualitative agreement between theory and experiment.
Author

N73-20302# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
HIGH SPEED WATER JETS FROM VERTICALLY ACCELERATED ROTATING CONES
P. Savic, J. D. Allan, and G. P. VanBlokland Dec. 1972 53 p refs
(MT-64) Avail: NTIS HC $4.75

Water jets are produced by vertically accelerating a rotating cone partially filled with water. It is shown that the acceleration of the parabolic meniscus results in a motion similar to that observed in a shaped explosive charge (Monroe jet). Accleration of the cone is effected by means of an inductive electromagnetic accelerating device (conical pinch) whose theory is developed in terms of the WKB approximation. A second order inviscid theory is presented of the motion of the fluid in the cone in terms of the Penney-Price linearization procedure and it is shown that good agreement for the jet head velocity can be achieved for low velocities. At higher velocities, experimental results appear to lag behind theory, probably owing to the dispersal of the jet head through viscous drag with the surrounding atmosphere. The shape of the jet at early times is well represented by first order theory.
Author

N73-20303# Technische Hochschule, Aachen (West Germany).
ACOUSTIC FEEDBACK OF A SUBSONIC AND SUPERSONIC FREE JET WHICH IMPINGES ON AN OBSTACLE
G. Neuwerth 1972 37 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-72) Avail: NTIS HC $4.00; DFVLR Porz-Wahn: 13,40 DM

It is reported that when a circular subsonic free jet impinges on an obstacle one can observe a stationary wave pattern in the jet core, periodical ring vortices in the jet boundary, and discrete frequencies of high intensity in the noise and turbulence spectrum. The sound pressure level is enlarged by about 10 db. These phenomena can be explained by the feedback between the flow and the pressure field generated by it. The Strouhal numbers are determined as a function of Mach number, jet temperature, nozzle diameter and distance between obstacle and nozzle. A pressure wave in the jet core which is responsible for feedback was also investigated.
Author

N73-20304*# Tulane Univ., New Orleans, La.
GAS VELOCITY AND TEMPERATURE NEAR A LIQUID ROCKET INJECTOR FACE Technical Report, Jul. 1971 - Aug. 1972
D. M. Boylan and J. OHara Jan. 1973 30 p refs
(Grant NGR-19-002-030)
(NASA-CR-121100) Avail: NTIS HC $3.50 CSCL 20D

The gas flow near the injector of a liquid propellant rocket was investigated by rapidly inserting butt-welded platinum-platinum rhodium thermocouples through the injector into the chamber. The transient responses of the thermocouples were analyzed to determine average gas temperatures and velocities. A method of fitting exponential curves to repeated measurements of the transient temperature at several positions near the injector face produced consistent results. Preliminary tests yielded gas flow directions and gas compositions at the injector face. Average gas temperatures were found to be between 3100 (1700) and 3500 F (1950 C) and the average gas velocities between 550 (170) and 840 feet/second (260 m/sec).
Author

N73-20305*# Clemson Univ., S.C.
DESIGN AND EXPERIMENTAL PERFORMANCE OF SHORT CURVED WALL DIFFUSERS WITH AXIAL SYMMETRY UTILIZING SLOT SUCTION
Tah-teh Yang, William G. Hudson, and Carl D. Nelson Washington NASA Mar. 1973 113 p refs
(Grant NGL-41-001-031)
(NASA-CR-2209) Avail: NTIS HC $3.00 CSCL 20D

The feasibility of designing short curved wall axially symmetrical subsonic diffusers utilizing suction through slots in the diffuser walls to prevent flow separation was investigated. A potential flow analysis was made, and a digital computer program was written for determining the diffuser wall contour for prescribed boundary conditions. The flow field included branch flow so that the suction slot geometry could be a part of the diffuser design. One bell shaped diffuser and three annular diffusers with area ratios of either 2.5:1 or 3:1 were designed, fabricated, and tested. Minimum suction requirements of metastable operation ranged from 6.3 percent to 12 percent when operating with inlet air velocities in the 1000 to 250 ft/sec (30 to 76 m/sec) range. For stable operation suction rates from 10 percent to 22 percent were required. In all cases the diffuser effectiveness was above 95 percent based on the conventional definition, and from 81 percent to 94 percent when the suction loss was accounted for. The exit velocity profiles were virtually flat with no more than + or - 9% variation over 95 percent of the exit area when operated with sufficient suction to prevent flow separation.
Author

N73-20306# Lehigh Univ., Bethlehem, Pa. Dept. of Physics.
ASPIRATING FLOW PATTERN AND PARTICLE INERTIA EFFECTS NEAR A BLUNT THICKWALLED TUBE ENTRANCE Technical Report, Nov. 1971 - Feb. 1973
David E. Kaslow and Raymond J. Emrich 15 Mar. 1973 37 p refs
(Grant DI-BM-GO110235)
(TR-23) Avail: NTIS HC $4.00

The flow pattern of air being aspirated into a blunt thickwalled tube was found. Lacking an analytic solution of the 3-dimensional problem, the flow pattern was found from photographs of submicrometer-sized oil drops carried by air drawn into the tube. Once the flow field was known, trajectories of particles of given sizes are calculated by numerical integration of the equations of motion employing the drag force formula. Sedimentation and wind effects were not included. These trajectories were used to determine whether particles in the respirable size range, 0.5 to 5 microns radius, succeed or fail in entering an actual sampling device because of inertia effects. It was found that all particles of all sizes up to 50 microns (far larger than these for which sedimentation can be neglected) enter the tube, although larger particles deviate noticeably from streamlines. Particles of 0.5 and 1 micron radius follow the streamlines, and although 5 microns radius particles deviate slightly from the streamlines, they also enter the tube.
Author

N73-20307*# Scientific Translation Service, Santa Barbara, Calif.
INCREASE OF SMALL DISTURBANCES IN THE BOUNDARY LAYER ON AN ELASTIC SURFACE
V. B. Amfilokhiyev, V. V. Droblennov, and A. S. Zavorokhina Washington NASA Mar. 1973 8 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), Mar. - Apr. 1972 p 137-139
(Contract NASw-2483)
(NASA-TT-F-14855) Avail: NTIS HC $3.00 CSCL 20D

The behavior of small disturbances in the laminar boundary layer on an elastic surface is analyzed. The analysis is based on the Orr-Sommerfeld equation with boundary conditions for a surface experiencing small deformations under the action of a perturbing pressure. It is shown that an increase in the elastic resilience of the surface leads to an increase in the critical Reynolds number, to a decrease in the range of the dangerous dimensionless perturbation frequencies, and to the deceleration of the rate of growth of the pulsating velocities.
Author

N73-20308*# Kanner (Leo) Associates, Redwood City, Calif.
METHOD OF CALCULATING THE FLOW IN A CIRCULAR NOZZLE
Yu. M. Danilov Washington NASA Mar. 1973 15 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekhn. (Kazan), v. 15, no. 2, 1972 p 60-66
(Contract NASw-2481)
(NASA-TT-F-14847) Avail: NTIS HC $3.00 CSCL 20D

A modification of the Newton-Kantorovich variational method is proposed for calculating flows in the subsonic and transonic portions of circular nozzles. The knowledge of these flows is necessary for solving the variational problem for the

supersonic portion of the nozzle. The method proposed is shown to be as accurate as the method of characteristics, but to provide substantial savings in computer time. Author

N73-20309*# Lockheed Electronics Co., Houston, Tex. Applied Mechanics Dept.
COMPUTATIONS OF NON-REACTING AND REACTING VISCOUS BLUNT BODY FLOWS, VOLUME 1
C. P. Li Feb. 1973 123 p refs 2 Vol.
(Contract NAS9-12200)
(NASA-CR-128871; TR2007-Vol-1) Avail: NTIS HC $8.25 CSCL 20D

The computer programs developed for computation of viscous shock layer flow distribution surrounding the nose of a shuttle orbiter during reentry are presented. The problem formulation and the numerical procedures used to solve the basic set of equations are described. The results of flow distribution properties at several trajectory points, ranging from the high altitude rarefied region to the low altitude boundary layer region are analyzed. Author

N73-20310*# Lockheed Electronics Co., Houston, Tex. Applied Mechanics Dept.
COMPUTATIONS OF NON-REACTING AND REACTING VISCOUS BLUNT BODY FLOWS, VOLUME 2
C. P. Li Feb. 1973 383 p 2 Vol.
(Contract NAS9-12200)
(NASA-CR-128872; TR2007-Vol-2) Avail: NTIS HC $21.25 CSCL 20D

Computer programs for calculating the flow distribution in the nose region of a blunt body at arbitrary speed and altitude are discussed. The programs differ from each other in their ability to consider either thin shock or thick shock conditions and in the use of either ideal, equilibrium air, or nonequilibrium air chemistry. The application of the programs to analyzing the flow distribution around the nose of the shuttle orbiter during reentry is reported. Author

N73-20311*# New York Univ., N.Y. Aerospace Lab.
DESCRIPTION OF A COMPUTER PROGRAM TO CALCULATE REACTING SUPERSONIC INTERNAL FLOW FIELDS WITH SHOCK WAVES USING VISCOUS CHARACTERISTICS: PROGRAM MANUAL AND SAMPLE CALCULATIONS
R. J. Cavalleri and Anthony M. Agnone [1972] 100 p refs
(Grant NGR-33-016-131)
(NASA-CR-112303) Avail: NTIS HC $7.00 CSCL 20D

A computer program for calculating internal supersonic flow fields with chemical reactions and shock waves typical of supersonic combustion chambers with either wall or mid-stream injectors is described. The usefulness and limitations of the program are indicated. The program manual and listing are presented along with a sample calculation. Author

N73-20312*# New York Univ., N.Y. Aerospace Lab.
COMPUTER PROGRAM FOR ASSESSING THE THEORETICAL PERFORMANCE OF A THREE DIMENSIONAL INLET
Anthony M. Agnone and Fanny Kung [1972] 52 p refs
(Grant NGL-33-016-119)
(NASA-CR-112304; NYU-AA-72-13) Avail: NTIS HC $4.75 CSCL 20D

A computer program for determining the theoretical performance of a three dimensional inlet is presented. An analysis for determining the capture area, ram force, spillage force, and surface pressure force is presented, along with the necessary computer program. A sample calculation is also included. Author

N73-20313*# California Inst. of Tech., Pasadena. Engineering and Applied Science Div.
DYNAMICS OF CAVITATING CASCADES Final Report
A. J. Acosta, C. Brennen, and J. H. Kim 15 Nov. 1972 18 p refs
(Contract NAS8-28046)
(NASA-CR-131415; E-184.1) Avail: NTIS HC $3.00 CSCL 20D

Brief accounts of the theoretical research conducted on the unsteady cavitation characteristics of liquid rocket engine turbopumps are reported. The objective is to produce estimates of the cavitation compliance and other unsteady characteristics which could then be used in analysis of the pogo instability. Blade cavitation is the particular phenomenon which is investigated and linearized free streamline methods were employed in both quasistatic and complete dynamic cascade analyses of the unsteady flow. The simpler quasistatic analysis was applied to particular turbopumps but yielded values of compliances significantly smaller than those indirectly obtained from experiments. Reasons for this discrepancy are discussed. The complete dynamic analysis presents a new problem in fundamental hydrodynamics and, though the basic solution is presented, numerical results have not as yet been obtained. Author

N73-20314# TRW Systems Group, Redondo Beach, Calif.
TURBULENT WAKES Semiannual Technical Report
E. Baum 30 Nov. 1972 43 p refs
(Contract N00014-72-C-0448; ARPA Order 1801)
(AD-752592; TRW-23028-6001-R0-00) Avail: NTIS CSCL 20/4

The report describes progress in developing model equations based on an eddy viscosity written in terms of the scalar quantities for turbulence energy and integral length scale. The turbulence model equations have been shown to adequately describe mean and turbulence properties for incompressible and compressible flat plate boundary layers. Properties of an implicit finite difference method for solving the time-dependent model equations are discussed as applied to laminar (Navier-Stokes) problems. The method appears to be stable, of second order accuracy in space and time, and well behaved in the presence of internal shocks. Author (GRA)

N73-20315# Naval Research Lab., Washington, D.C.
SHAS2D: A FULLY COMPRESSIBLE HYDRODYNAMICS CODE IN TWO DIMENSIONS
Jay P. Boris 6 Dec. 1972 53 p refs
(AD-754736; NRL-MR-2542) Avail: NTIS CSCL 20/4

The report provides documentation for the SHAS2D computer code, a flexible, highly optimized program for solving fully compressible, two-dimensional hydrodynamics problems. The numerical techniques are discussed in detail, the properties of the code are described, and the input data format is given. This program was the starting point for the multidimensional hydrodynamics program at NRL which use the Boris-Book flux-corrected transport algorithms. Sample results from simple calculations are presented. Author (GRA)

N73-20316# ARO, Inc., Arnold Air Force Station, Tenn.
LOW-DENSITY BOUNDARY-LAYER MODULATION BY SUCTION IN A HYPERSONIC NOZZLE Final Report, 8 Jun. 1970 - 30 Jun. 1972
M. Kinslow, M. R. Busby, and J. L. Potter AEDC Oct. 1972 37 p refs Sponsored by AF
(ARO Proj. VT0089; ARO Proj. VT5174)
(AD-754276; ARO-VKF-TR-72-143; AEDC-TR-72-178) Avail: NTIS CSCL 14/2

The potential value of controlled boundary-layer removal from the wall of a nozzle for low-density hypersonic flow was investigated in a brief experimental program. A particular objective was the achievement of sufficient control over boundary-layer thickness to enable a contoured nozzle to be operated under off-design conditions without excessive deterioration of flow uniformity. The nozzle contour was greatly influenced by boundary-layer thickness. Boundary-layer removal involved suction through perforated walls where local nozzle static pressures exceeded the pressure in the large tank which enclosed the nozzle and test section. Author (GRA)

N73-20317# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
A STUDY OF THE COMPUTATION OF REGULAR SHOCK REFLECTION WITH NAVIER-STOKES EQUATIONS
Neale A. Messina and Sin-I Cheng Dec. 1972 32 p refs Presented at Symp. on Appl. of Computers to Fluid Dyn. Analysis and Design, Brooklyn, N. Y., 3-4 Jan. 1973
(Contract N00014-67-A-0150-0028)
(AD-754095; Internal-Memo-43) Avail: NTIS CSCL 20/4

The report is concerned with the computational aspects of the finite difference treatment of the Navier-Stokes equations

for generating and maintaining a straight oblique shock wave of prescribed sttrength in a steady, uniform, supersonic flow and computing accurately the inviscid flow field downstream of the shock wave. The computational error associated with the special case of shock reflection from a plane inviscid wall establishes an upper bound of the error to be anticipated in the inviscid field in future studies of the interaction of an oblique shock wave with viscous layers. Author (GRA)

N73-20318# Delaware Univ., Newark. Coll. of Marine Studies.
KELVIN-HELMHOLTZ INSTABILITY OF BOUNDED TWO-PHASE PARTICULATE FLOW
Jiunn H. Chou and Barry S. Seidel Nov. 1972 35 p refs
(Contractt N00014-69-A-0407; NR Proj. 388-096)
(AD-754815; TR-20) Avail: NTIS CSCL 20/4

A theoretical analysis is given for the instability of a system with bounded or unbounded upper and lower fluids, with a particulate in each fluid which can be droplets, particles, or bubbles. The volume fraction and velocity index of the particulate in each fluid are introduced, and the appropriate dimensionless parameters are used to describe the system. The mathematical formulation is cast in the form of a linear, normal mode, stability analysis. The resulting differential equations and boundary conditions are solved, and characteristic equations result. Author (GRA)

N73-20319# Michigan Univ., Ann Arbor. Gas Dynamics Lab.
THE STRUCTURE OF THE REYNOLDS STRESS IN A TURBULENT BOUNDARY LAYER
Shui-Shong Lu and William W. Willmarth Oct. 1972 134 p refs
(Contract N00014-67-A-0181-0015)
(AD-754758; UMICH-021490-2-T) Avail: NTIS CSCL 20/4

Experimental studies of the structure of the Reynolds stress in a turbulent boundary layer on a smooth wall with zero pressure gradient are reported. The technique of conditional sampling is employed to study the signal, uv, obtained from hot wire probes in a x configuration. Measurements of the mean time intervals and durations of burst and sweeps are attempted. In the conditional sampling method the velocity at the edge of the viscous sublayer is used as a detector of bursts and the signal, uv, is obtained at various locations. Velocity is studied in relation to bursts and sweep events. Author (GRA)

N73-20320# Naval Research Lab., Washington, D.C. Plasma Physics Div.
A SERIES OF LECTURES ON ROTATING AND STRATIFIED FLUIDS
Albert I. Barcilon Nov. 1972 161 p refs
(AD-754066; NRL-MR-2533) Avail: NTIS CSCL 20/4

The report is a collection of lectures given at the Naval Research Laboratory during July and August of 1971. This course on rotating and stratified fluids was offered to a Ph.D. audience with past experience in kinetic theory, plasma physics and continuum fluid dynamics. Author (GRA)

N73-20321# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
RESONANT OSCILLATIONS WITH DAMPING IN OPEN TUBES
Michael R. Mortell and Bryan R. Seymour (New York Univ.) Aug. 1972 61 p refs
(Contract DAAD05-71-C-0389)
(AD-754647; CAM-140-3; BRL-CR-76) Avail: NTIS CSCL 20/4

A gas in a tube, one end of which is open, is driven by the periodic motion of a piston operating at or near a resonant frequency. Damping is introduced into the system by radiation of energy through the open end. It is shown that the boundedness of the resonant motion depends on the third order elastic constant in the equation of state. The effect of damping on the motion is investigated, and the different signals which result for different ranges of damping and frequency are delineated. There is qualitative agreement with experiment. Author (GRA)

N73-20322# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
THE INTERACTION OF LARGE AMPLITUDE SHALLOW WATER WAVES WITH AN AMBIENT SHEAR FLOW: CRITICAL AND NONCRITICAL FLOWS
P. A. Blythe, Y. Kazakia, and E. Varley Sep. 1972 138 tp refs
(Contract DAAD05-69-C-0053)
(AD-754646; CAM-110-23; BRL-CR-75) Avail: NTIS CSCL 20/4

A nonlinear analysis is given of the behavior of a gravity wave moving over a horizontal bed into a region where the flow is sheared in a vertical direction. No restriction is placed on the amplitude of the wave. The only assumptions made are that the fluid is inviscid and that the hydrostatic pressure law holds. The results can be used to analyze the behavior of tsunamis and weather fronts. Author (GRA)

N73-20323# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECIAL PROPERTIES OF SUPERSONIC GAS FLOWS IN PERFORATED BOUNDARIES
G. L. Grodzovakii 5 Jan. 1973 11 p ref Transl. into ENGLISH from Teplo Massoperenos (Minsk), no. 4, 1969 p 459-461
(AF Proj. G101)
(AD-754601; FTD-HT-23-1658-72) Avail: NTIS CSCL 20/4

The development history, operating principles, and potentialities of supersonic nozzles with perforated edges are briefly discussed. It is pointed out that the properties of supersonic flows in perforated boundaries can be used in many regions of technology. Author (GRA)

N73-20324# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEVELOPMENT AND MIXING OF A COAXIAL JET IN AXISYMMETRIC SWIRLING FLOW
R. Lyane and Yu. Ivanov 30 Oct. 1972 20 p refs Transl. into ENGLISH from Izv. Akad. Nauk Est. SSR, Ser. Fiz., Mat. (Tallinn), v. 20, no. 1, 1971 p 58-65
(AD-754613; FTD-MT-24-1111-72) Avail: NTIS CSCL 20/4

The results of an experimental study on the developing and mixing of jet with vortex flow in cylindrical chamber are presented. The study was carried out for several diameter ratios of jet and chamber and a range of mass flows of stream and jet. Various influences of the mass flow of stream on the mixing of jet depending on the value of geometrical parameter d sub zero/D sub k are determined. Author (GRA)

N73-20325# Army Foreign Science and Technology Center, Charlottesville, Va.
INTERACTION OF RAREFIED GAS WITH THE SURFACES OF POROUS BODIES DURING EVAPORATION
B. M. Smolskii 21 Dec. 1962 5 p Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 20, no. 1, 1971 p 148-150
(AD-754633; FSTC-HT-23-2084-72) Avail: NTIS CSCL 20/4

The flow patterns of vapor-gas mixtures at the surfaces of moist porous bodies of various forms undergoing heat and mass transfer were determined by visual and motion-picture methods. Author (GRA)

N73-20326# Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.
A STUDY OF THE EFFECTS OF BOUNDARY LAYER ON AXISYMMETRIC JET-ON BASE PRESSURE IN TRANSONIC AND SUPERSONIC FLOWS Final Summary Report
Alva L. Addy Dec. 1972 13 p refs
(Contract DAAH01-70-C-0888)
(AD-754640) Avail: NTIS CSCL 20/4

The onset and effects of plume-induced boundary-layer separation on the afterbody during powered supersonic flight were investigated. Plume-induced separation occurs for configurations designed for overall drag reduction since boattailing, base bleed, nozzle exit angle, and nozzle extension tend to increase significantly the base pressure. However, each configuration and set of operating conditions must be studied. The purpose of this report is to present only a brief summary of the investigation and to reference the publications which contain the details. GRA

N73-20327# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ZONE OF FLOW REVERSAL IN RAPIDLY ROTATING

SUPERSONIC GAS FLOWS AND JETS
Yu. A. Gostintsev, V. S. Ilyukhin, and P. F. Pokhil 27 Dec. 1972 14 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Moscow), v. 20, no. 6, 1971 p 1036-1047
(AD-754617; FTD-MT-24-1585-72) Avail: NTIS CSCL 20/4

Results are reported of an experimental study of the near-axial zone of flow reversal of a rotating supersonic underexpanded jet and of a helical gas flow in the diffuser section of the nozzle. Author (GRA)

N73-20328# Army Foreign Science and Technology Center, Charlottesville, Va.
AN APPROXIMATE SOLUTION OF A TWO-DIMENSIONAL PROBLEM OF NON-STEADY STATE STRATAL FLOW WITH A MOVABLE GAS-LIQUID INTERFACE
R. M. Mustafaev 30 Oct. 1972 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk Azerb. SSR, Ser. Fiz.-Tekhn. Mat. Nauk (Baku), no. 5, 1969 p 72-76
(AD-754828; FSTC-HT-23-961-72) Avail: NTIS CSCL 20/4

A theoretical investigation of the problem of retaining gas in horizontal and sloping water-bearing strata and a successful experimental-industrial test of the methodology developed are reported. GRA

N73-20329# Army Engineer Waterways Experiment Station, Livermore, Calif. Explosive Excavation Research Lab.
ESTIMATING WATER-SHOCK-INDUCED AIRBLAST FROM DETONATIONS IN A MEDIUM OVERLAIN WITH WATER Final Report
C. M. Snell Apr. 1972 65 p erefs
(AD-755099; EERL-TR-72-16) Avail: ENTIS CSCL 19/4

A geometrical shock wave transmission model is used to determine water surface peak spall velocities above single-charge cratering detonations in a medium overlain by a thin-to-moderately-thick layer of water. These velocities, in conjunction with an acoustic simple source treatment, predict the water-shock-induced airblast from such events. Required input data include the acoustic impedance and shock wave transmission properties of the cratering medium in the inelastic and elastic regions. The method is intended to predict far-field airblast in the low overpressure regime, for which case the acoustic simple source treatment is valid. A computer code called MULTIMEDIA is included with this report as an aid to numerical prediction calculations. Author (GRA)

N73-20330# ARO, Inc., Arnold Air Force Station, Tenn.
STATIC STABILITY AND AXIAL FORCE CHARACTERISTICS OF SEVERAL FLAT-FACED RIGHT CIRCULAR CYLINDERS AT SUBSONIC AND SUPERSONIC SPEEDS AND ANGLES OF ATTACK FROM 0 TO 90 DEGREES Final Report, 6-13 Jul. 1972
R. W. Rhudy and S. S. Baker AEDC Jan. 1973 87 p refs Sponsored by AEC
(AF Proj. 6065)
(AD-754920; ARO-VKF-TR-72-152; AEDC-TR-72-180) Avail: NTIS CSCL 20/4

Tests were conducted at Mach numbers from 0.2 to 0.8 and 1.5 to 2.5 to determine the effects of fineness ratio and angles of attack up to 90 degrees on the static longitudinal stability and axial force of a flat-faced cylinder. Tabulated and plotted data for the entire test matrix are presented. Author (GRA)

N73-20331# Wisconsin Univ., Madison. Mathematics Research Center.
A NOTE ON THE FLOW TOROIDAL OSCILLATIONS OF A THIN SPHERICAL SHELL OF CONDUCTING FLUID Technical Summary Report
K. B. Ranger Oct. 1972 11 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-755059; MRC-TSR-1276) Avail: NTIS CSCL 20/4

Slow oscillations of a thin spherical shell of conducting fluid in the presence of a toroidal magnetic field are shown to drift eastward in agreement with the work of Stewartson. The result is established very simply by suitable choice of basic magnetic field. Author (GRA)

N73-20332# Wisconsin Univ., Madison. Mathematical Research Center.
ON THE STABILITY OF ELONGATIONAL FLOW OF VISCOELASTIC LIQUIDS. 1: THE RUBBERLIKE LIQUID WITH A SINGLE EXPONENTIAL MEMORY FUNCTION
Hui Chang, A. S. Lodge, and J. B. McLeod (Wadham Coll., Oxford, Engl.) Nov. 1972 41 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-755065; MRC-TSR-1246) Avail: NTIS CSCL 07/4

The report involves the spinnability of high polymers. A new, simple method of analyzing the stability of elongational flow of a cylindrical liquid filament is presented. At time t, the filament is assumed to be composed of two uniform cylinders, of unequal cross-sectional areas A(1)(t), A(2)(t), connected end to end. A constant, uniform tensile force F is suddenly applied at t equals 0. Using the rubberlike liquid constitutive equations, the area ratio A(1)(t)/A(2)(t) can be obtained from solutions of a non-linear Volterra integral equation. Numerical solutions are obtained by two independent methods: a step-by-step integration of the Volterra equation, and a Runge-Kutta solution of the non-linear second-order ordinary differential equation to which the Volterra equation can be reduced. GRA

N73-20333# Naval Intelligence Support Center, Washington, D.C. Translation Services Div.
DIGITAL SYSTEM POTOK (FLOW) FOR INVESTIGATING SHIP MODELS
G. V. Belyaev, G. N. Kachulin, and Yu. F. Motienko 13 Dec. 1972 26 p Transl. into ENGLISH the publ. "Tsifrovaya Sistem Potok diya Issledovaniya Modeley Sudov" Leningard, Shipbuilding Press, 1970 p 3-26
(AD-755005; NISC-Trans-3374) Copyright. Avail: NTIS CSCL 13/10

The report describes an operating digital system, designed for automating the mathematical processing of the research results obtained on models of ships in wind tunnels. The book is oriented toward a broad group of specialists concerned with the development and application of specialized digital computers for automating the experimental research and production processes both in shipbuilding and in other branches of science and technology. The book will also be useful to students specializing in the field of digital computer engineering. Author (GRA)

N73-20334# Harry Diamond Labs., Washington, D.C.
DEVELOPMENT OF AN E-FRAME FLUIDIC TRANSDUCER Technical Report, Mar. - Jul. 1972
H. Steven Kimmel Dec. 1972 21 p refs
(DA Proj. 1W2-62301-A-30; HDL Proj. A20334)
(AD-755104; HDL-TM-72-28) Avail: NTIS CSCL 13/7

A theoretical analysis has been conducted to develop a new transducer for use with fluidic generators. Evolving from this study is an E-frame generator that employs an improved magnetic circuit. This circuit consists of an E-shaped reed whose center member vibrates inside a stationary coil. Unlike previous models of the fluidic generator, the reed-coil assembly is positioned outside the magnet-pole piece assembly to reduce eddy current losses. The new design is capable of providing 0.180 W at 210 fps and 2.2 W at 1000 fps. The report describes the analysis made and evaluates the design parameters investigated during the study. Author (GRA)

N73-20335# California Univ., Berkeley. Dept. of Mechanical Engineering.
DISCRETIZATION OF A VORTEX SHEET, WITH AN EXAMPLE OF A ROLL-UP
Alexandre J. Chorin and Peter S. Bernard Nov. 1972 17 p refs
(Contract N00014-69-A-0200-1052)
(AD-755007; FM-72-5) Avail: NTIS CSCL 20/4

The point vortex approximation of a vortex sheet in two space dimensions is examined and a remedy for some of its shortcomings is suggested. The approximation is then applied to the study of the roll-up of a vortex sheet induced by an elliptically loaded wing. Author (GRA)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N73-20336 National Lending Library for Science and Technology, Boston Spa (England).

EFFECT OF CIRCULATION FEATURES IN THE LOWER STRATOSPHERE ON THE FORMATION OF TEMPERATURE ANOMALIES AT THE EARTH'S SURFACE

V. S. Bedrina, A. L. Kac, and V. I. Knjazeva [1972] 10 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchn.-Issled. Tsentr. SSSR (Leningrad), v. 76, 1971 p 10-18

(NLL-M-22851-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Sharp changes of surface temperature anomalies in the European U.S.S.R. were investigated by studying the development of macro-processes in the lower stratosphere from 1960 to 1968. Stratospheric circulation at the 100 mb level was examined. A correlation was found between air temperature anomaly and corresponding positions of groups of cyclonic vortices. The mechanism of this relationship undergoes monthly variations, and an account of how these variations affect surface temperature anomalies is provided. J.M.M.

N73-20337 National Lending Library for Science and Technology, Boston Spa (England).

FLUCTUATIONS OF THE NORTHERN HEMISPHERE ZONAL ATMOSPHERIC CIRCULATION IN THE FIRST HALF OF THE CENTURY

A. S. Caplygina [1972] 17 p refs Transl. into ENGLISH from Vosprosy Geog. (USSR), v. 79, 1970 p 68-81

(NLL-M-22855-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Long term variations of atmospheric circulation in the Northern Hemisphere were investigated for the first half of the 20th century. It was determined that two major circulation epochs occurred: meridional (up to the 1920's) and zonal (from the beginning of the 1920's until the early 1950's). Meridional circulation is closely identified with polar and continental anticyclones, and predominates in the cold half of the year. Zonal circulation, conversely, arises from the movement of the pressure systems over the oceans and is identified with summer cyclonic activity. It is concluded that one or the other of these 15 to 30 year epochs is brought about by a convergence of solar, electromagnetic, and cyclonic influences intense enough to insure continuation into the following year. J.M.M.

N73-20338 National Lending Library for Science and Technology, Boston Spa (England).

DEPENDENCE OF BUMPINESS IN THE STRATOSPHERE ON THE HORIZONTAL DISTRIBUTION OF TEMPERATURE AND WIND

G. S. Buldovskij [1972] 11 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchn.-Issled. Tsentr. SSSR (Leningrad), v. 70, 1970 p 93-104

(NLL-M-22823-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The relationship between bumpiness in the stratosphere and the horizontal distribution of meteorological parameters was investigated using the results of instrumental measurements of turbulence in the stratosphere. These measurements were obtained from 65 flights by a special laboratory aircraft at heights from 10 to 19 km. Values of meteorological parameters were read from 300 mb, 200 mb, and 100 mb contour charts, and 150 mb and 70 mb charts drawn especially for the region of flight. Horizontal gradients were calculated from temperatures and wind speeds read from charts at points 300 km apart. Author

N73-20339 National Lending Library for Science and Technology, Boston Spa (England).

TECHNIQUE OF CALCULATING THE THERMAL REGIME OF SOILS AT DEPTHS OF 5, 10 AND 20 CMS FROM THE TEMPERATURE AND HUMIDITY OF THE AIR MEASURED AT THE METEOROLOGICAL STATIONS

A. R. Konstantinov and L. V. Popovic [1972] 13 p refs Transl. into ENGLISH from Glav. Geof. Obs. Clim. Soil, Proc. Conf. Sci. Counc. Study Olim. Agroclim. Res. (Leningrad), Nov. 1969 p 146-155

(NLL-M-22802-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Physico-statistical analyses of meteorological station observations on the thermal regime of the soil are used to form graphs by means of which the soil temperatures at depths of 5, 10 and 20 cm can be determined from air temperature and humidity measurements at a height of 2 m. Author

N73-20340 National Lending Library for Science and Technology, Boston Spa (England).

QUANTITATIVE DETERMINATION OF CARBON MONOXIDE IN THE ATMOSPHERE

T. Fujita et al Nov. 1972 14 p refs Transl. into ENGLISH from Bunseki Kagaku (Tokyo), v. 19, no. 12, 1970 p 1624-1628

(NLL-RTS-7573) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.30; 4 NLL photocopy coupons

A method for measuring the amount of carbon monoxide in the atmosphere is reported. The carbon monoxide is oxidized to carbon dioxide and absorbed in a standard alkaline solution. The electrical conductivity of the solution is then measured, and the quantity of residual carbon monoxide is determined by the changed electrical conductivity. It was found that the combination of hopcalite and lead dioxide as the oxidizing agent brings about the greatest amount of electrical conductivity in the solution, thus providing the most precise measurements of carbon monoxide in the atmosphere. Author

N73-20341 National Lending Library for Science and Technology, Boston Spa (England).

ON THE FORMATION OF UPPER FRONTAL ZONES

V. V. Ovsjannikov [1972] 5 p refs Transl. into ENGLISH from Tr. Vyp. Nauc.-Issled. Inst. Aeroklim. (USSR), v. 66, 1970 p 148-151

(NLL-M-22824-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon CSCL 04A

The unstable region of the troposphere was investigated to determine whether or not prior theoretical results relative to upper frontal zones can be confirmed empirically. Sloping parts of the troposphere were identified in a regular pattern from the equator to the poles such that the greater the angle of the tropopause to the horizontal, the greater in magnitude is the change in the horizontal temperature gradient. It was concluded that empirical observations do confirm the theoretical results that frontal zones in the upper atmosphere are basically caused and maintained by the sloping parts of the tropopause. J.M.M.

N73-20342 National Lending Library for Science and Technology, Boston Spa (England).

AEROSYNOPTIC CONDITIONS IN WHICH TURBULENCE OCCURS IN THE STRATOSPHERE OVER MIDDLE LATITUDES IN THE USSR

G. S. Buldovskij [1972] 14 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchn.-Issled. Tsentr. SSSR (Leningrad), v. 45, 1969 p 57-70

(NLL-M-22822-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Analysis is made of the measurements of meteorological conditions of bumpiness in the stratosphere from 15 experimental flights over the central regions of the European USSR from 23 March to 6 June 1967. These flights, conducted at an altitude of 18 km, covered the period of spring reorganization of synoptic processes in the stratosphere over middle latitudes. These processes are characterized by the weakening of winter cyclonic movements into summer anticyclones. The studies revealed a significantly greater degree of bumpiness over the southern edge of the polar depression - a fact attributable to greater cyclonic circulation. J.M.M.

N73-20343*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.

INVESTIGATION OF TECHNIQUES FOR CORRECTING ERTS DATA FOR SOLAR AND ATMOSPHERIC EFFECTS Interim Report, Aug. 1972 - Jan. 1973

Robert H. Rogers, Principal Investigator Feb. 1973 34 p ref

(Contract NAS5-21863)
(E73-10349; NASA-CR-130823; BSR-4014) Avail: NTIS HC $3.75 CSCL 04A

There are no author-identified significant results in this report.

N73-20344*# Earth Satellite Corp., Berkeley, Calif.
A SCHEME FOR THE UNIFORM MAPPING AND MONITORING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES USING ERTS-1 IMAGERY Progress Report, 1 Jan. - 28 Feb. 1973
Charles E. Poulton, Principal Investigator and Robin I. Welch 20 Mar. 1973 5 p
(Contract NAS5-21830)
(E73-10350; NASA-CR-131131; PR-3) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-20345*# Natural Resources Management Corp., Berkeley, Calif.
INVESTIGATION OF THE DETECTION AND MONITORING OF FOREST INSECT INFESTATION IN THE SIERRA NEVADA MOUNTAINS OF CALIFORNIA Progress Report, 1 Feb. - 31 Mar. 1973
Ralph C. Hall, Principal Investigator 31 Mar. 1973 5 p
(Contract NAS5-21770)
(E73-10351; NASA-CR-131132) Avail: NTIS HC $3.00 CSCL 02F

The author has identified the following significant results. Significant progress has been made in detecting insect outbreaks from ERTS-1 data during this period. It is possible to differentiate forested areas with heavy damage from those with little or no damage. The analysis is made with color infrared positive transparencies and prints. Enlargement of the transparencies makes it possible to detect and map areas of three degrees of tree mortality into heavy, medium, and light. It was also noted that shadows cast by massive rock domes closely resemble natural lakes.

N73-20346*# Alaska Univ., Fairbanks. Inst. of Marine Science.
SEA-SURFACE CIRCULATION, SEDIMENT TRANSPORT, AND MARINE MAMMAL DISTRIBUTION, ALASKA CONTINENTAL SHELF Progress Report, Jul. 1972 - Jan. 1973
Frederick F. Wright, Principal Investigator, G. D. Sharma, and J. J. Burns 20 Feb. 1973 37 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21833)
(E73-10370; NASA-CR-131011) Avail: NTIS HC $4.00 CSCL 08A

The author has identified the following significant results. Even though nonsynchronous, the ERTS-1 imagery of November 4, 1972, showed a striking similarity to the ground truth data obtained in late August and September, 1972. The comparison of the images with ground truth data revealed that the general water circulation pattern in Lower Cook Inlet is consistent through the Fall season and that ERTS-1 images in MSS bands 4 and 5 are capable of delineating water masses with a suspended load as low as 1 mg/liter. The ERTS-1 data and the ground truth data demonstrate clearly that the coriolis effect dominates circulation in Lower Cook Inlet. The configuration of plumes in Nushagak and Kuskokwim bays further indicates the influence of the coriolis effect on the movement of sea water at high latitudes. Comparison of MSS bands 4, 5, 6, and 7 suggest MSS-1 penetration of several meters into the water column. Sea ice analysis of available imagery was exceptionally rewarding. The imagery provided a rapid method to delineate and describe the ice types apparent in the photos. The ice types ranged from newly formed grease ice to heavy flows of disintegrating shore-fast ice. Sea ice maps showing the extent of different ice zones in the Chukchi Sea are being compiled.

N73-20347*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF ERTS-1 DATA TO THE PROTECTION AND MANAGEMENT OF NEW JERSEY'S COASTAL ENVIRONMENT Semiannual Progress Report
Roland S. Yunghans, Edward B. Feinberg, Frank J. Wobber, Robert L. Mairs, Principal Investigators, Donald Garofalo, David A. Thibault, Roger V. Amato, and Lawrence R. Pettinger 12 Jan. 1973 61 p Prepared for N. J. Dept. of Environ. Protection
(Contract NAS5-21765)
(E73-10022; NASA-CR-129952) Avail: NTIS HC $5.25 CSCL 08J

The author has identified the following significant results. This catalogue was prepared as a part of the joint ERTS-1 New Jersey coastal mapping experiment. First look analysis of ERTS-1 images indicates that numerous coastal oceanographic patterns can be mapped on a sequential basis using ERTS-1 images. Analysis of imagery indicates a predominant southwesterly drift of dumped wastes in the surface waters. Initial analysis of imagery indicates that the effects of tidal flushing of New York harbor extend as far south as Long Branch, New Jersey. Analysis of imagery from 3 September, 1972, indicates a wide band of turbid water extending several miles offshore around Barnegat Inlet. First look analysis of imagery from 10 October, 1972, illustrates the increased reflectance of turbid waters within the bays, sounds, and thoroughfares behind the barrier islands in the southern New Jersey shore area. The estuarine waters emanating from both Brigantine and Absecon Inlets are very turbid relative to the waters further offshore and to the north and south. The tidal prism appears to be quite large but the movement of water once outside the inlets is not very rapid. The waters are not moving away from the coastline but rather along the coast.

N73-20348*# Purdue Univ., Lafayette, Ind.
EVALUATION AND COMPARISON OF ERTS MEASUREMENTS OF MAJOR CROPS AND SOIL ASSOCIATIONS FOR SELECTED SITES IN THE CENTRAL UNITED STATES Bimonthly Progress Report, 1 Jan. - 28 Feb. 1973
Marion F. Baumgardner, Principal Investigator 28 Feb. 1973 3 p
(Contract NAS5-21785)
(E73-10384; NASA-CR-131133) Avail: NTIS HC $3.00 CSCL 02C

There are no author-identified significant results in this report.

N73-20349*# Environmental Research Inst. of Michigan, Ann Arbor.
[PROCESSING AND ANALYSIS OF ERTS-1 REMOTELY SENSED DATA] Bimonthly Report, 1 Jan. - 28 Feb. 1973
Frederick J. Thomson, Principal Investigator 15 Mar. 1973 53 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21783)
(E73-10387; NASA-CR-131053; Rept-193300-6-L; BMR-4) Avail: NTIS CSCL 05B

Research progress on the processing, analysis, and management of ERTS-1 data is reported. Subject areas covered are: (1) water depth measurement in Little Bahama Bank; (2) terrain classification mapping of Yellowstone National Park, Wyoming; (3) atmospheric effects on ERTS-1 data; (4) lake ice surveillance in Michigan; (5) application of dielectic constant measurements to radar imagery interpretation; (6) recreational land use in Michigan; (7) IFYGL data on Lake Ontario and its drainage basin; (8) advanced information extraction techniques; (9) water quality monitoring in New York Bight and Tampa Bay areas; (10) oil pollution detection in Gulf of Mexico and waters off Salem, Massachusetts and Oakland, California; and (11) mapping iron ore deposits in Wind River Range, Wyoming. For individual titles, see N73-20350 through N73-20359.

N73-20350* Environmental Research Inst. of Michigan, Ann Arbor.
TASK 1: WATER DEPTH MANAGEMENT, 1388
Fabian C. Polcyn, Principal Investigator *In its* Process. and Analysis of ERTS-1 Remotely Sensed Data 15 Mar. 1973 8 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 (For availability see N73-20349 11-13)
(E73-10388) CSCL 08C

The author has identified the following significant results. ERTS-1 MSS data taken on October 10, 1972, of the Little Bahama Bank are being used to demonstrate the use of ERTS-1 data for mapping of shallow water features for the purpose of

upgrading world navigation charts. Marked reflectance differences occur for the shallow water areas in bands 4, 5, and 6. Digital processing of two adjacent data tapes within the ERTS-1 frame covering an area of about 40 by 40 miles has been completed. Correlation of depth measurements to 5 meters has been successful. A mathematical model for depth measurements using ratio of voltages in band 4 and 5 has been successfully developed and is being tested for accuracy. Additional studies for areas near Puerto Rico and in northern Lake Michigan will be undertaken. Satellite data will also provide geographical evidence for verifying existence or nonexistence of doubtful shoal waters now appearing on world charts and considered to be hazardous to shipping.

N73-20351* Environmental Research Inst. of Michigan, Ann Arbor.
TASK 2: YELLOWSTONE NATIONAL PARK DATA, 1398
Fred J. Thomson, Principal Investigator *In its* Process. and Analysis of ERTS-1 Remotely Sensed Data 15 Mar. 1973 1 p (For availability see N73-20349 11-13)
(E73-10389) CSCL 08B

There are no author-identified significant results in this report.

N73-20352* Environmental Research Inst. of Michigan, Ann Arbor.
TASK 3: ATMOSPHERIC EFFECTS IN ERTS-1 DATA, 1410
Fred J. Thomson, Principal Investigator *In its* Process. and Analysis of ERTS-1 Remotely Sensed Data 15 Mar. 1973 1 p (For availability see N73-20349 11-13)
(E73-10390) CSCL 04A

The author has identified the following significant results. Results of crop mensuration and recognition studies in the Sacramento Valley indicate that the measurement of acreages of rice fields from ERTS-1 data can be dramatically improved by utilizing a processing technique which estimates the proportion of rice and bare soil in field boundary elements classified as corn by conventional pattern recognition techniques.

N73-20353* Environmental Research Inst. of Michigan, Ann Arbor.
TASK 4: LAKE ICE SURVEILLANCE, 1406
L. Porcello, Principal Investigator and M. L. Bryan *In its* Process. and Analysis of ERTS-1 Remotely Sensed Data 15 Mar. 1973 7 p (For availability see N73-20349 11-13)
(E73-10391) CSCL 08L

The author has identified the following significant results. Although it is readily recognized that there is a need for ground truth to provide adequate guidance for remote sensing data interpretation, it is noted that, in terms of radar remote sensing, this ground truth is often inadequate. It is necessary to make basic electrical and physical measurements of the surface and to some depth below it. A brief outline is presented of a ground truth scheme which uses measurements of the dielectric constant. Two portable instruments were designed specifically for this purpose; these were: (1) a Q-meter for measurement of dielectric constant and loss tangent; and (2) an instrument to measure electrical properties of the two operating frequencies of the imaging radar. Although extensive data are lacking, several general cases of radar-earth surface and interaction are described; also, examples of radar imagery and some data on ice and snow are presented. It is concluded that the next logical step is to begin to quantify the radar ground truth in preparation for machine interpretation and automatic data processing of the radar imagery.

N73-20354* Environmental Research Inst. of Michigan, Ann Arbor.
TASK 5: RECREATIONAL LAND USE, 1387
I. Sattinger, Principal Investigator *In its* Process. and Analysis of ERTS-1 Remotely Sensed Data 15 Mar. 1973 3 p (For availability see N73-20349 11-13)
(E73-10392) CSCL 08F

There are no author-identified significant results in this report.

N73-20355* Environmental Research Inst. of Michigan, Ann Arbor.
TASK 6: IFYGL (LAKE ONTARIO), 1384
Fabian C. Polcyn, Principal Investigator *In its* Process. and Analysis of ERTS-1 Remotely Sensed Data 15 Mar. 1973 9 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 (For availability see N73-20349 11-13)
(E73-10393) CSCL 08H

The author has identified the following significant results. The Lake Ontario drainage basin covers over 32,000 miles of U.S. and Canadian territory. ERTS-1 data is contributing to the comprehensive study of this basin as part of the International Field Year for the Great Lakes (IFYGL). A processing approach is described for obtaining detailed and objective synoptic information thought to be applicable to terrestrial water balance studies of such a large area. A simple ratio algorithm was tested for minimizing daily variations in ERTS-1 data and for allowing the discrimination of surface features and land use classes of hydrologic significance. These steps are necessary if ERTS-1 data is to provide the quantitative information required for the study and management of areas of regional size.

N73-20356* Environmental Research Inst. of Michigan, Ann Arbor.
TASK 7: IMAGE ENHANCEMENT AND ADVANCED INFORMATION EXTRACTION TECHNIQUES, 1385
W. A. Malila and R. F. Nalepka, Principal Investigators *In its* Process. and Analysis of ERTS-1 Remotely Sensed Data 15 Mar. 1973 9 p refs (For availability see N73-20349 11-13)
(E73-10394) CSCL 08F

The author has identified the following significant results. Atmospheric effects in satellite multispectral scanner data can influence results obtained with either manual image interpretation or computer information extraction techniques. The atmosphere attenuates radiation arriving from the surface and adds an extraneous path radiance component. Initial results of an investigation of atmospheric effects in ERTS-1 data are presented. Empirical analyses of ERTS-1 MSS data and simultaneous airborne MSS underflight data for one frame, along with theoretical calculations of atmospheric effects, are discussed. The effect of limited spatial resolution on the accuracy of information extracted from ERTS-1 data also is important. Problems occur when individual resolution elements contain two or more materials. Results from an initial application of Environmental Research Institute of Michigan techniques for estimating proportions of materials within individual elements are presented and discussed. Very accurate determination of surface areas of small lakes is achieved.

N73-20357* Environmental Research Inst. of Michigan, Ann Arbor.
TASK 8: WATER QUALITY MONITORING, 1400
C. T. Wezernak, Principal Investigator *In its* Process. and Analysis of ERTS-1 Remotely Sensed Data 15 Mar. 1973 1 p (For availability see N73-20349 11-13)
(E73-10395) CSCL 08H

There are no author-identified significant results in this report.

N73-20358* Environmental Research Inst. of Michigan, Ann Arbor.
TASK 9: OIL POLLUTION DETECTION, 1389
Robert Horvath, Principal Investigator *In its* Process. and Analysis of ERTS-1 Remotely Sensed Data 15 Mar. 1973 2 p (For availability see N73-20349 11-13)
(E73-10396) CSCL 08H

There are no author-identified significant results in this report.

N73-20359* Environmental Research Inst. of Michigan, Ann Arbor.
TASK 10: AN ERTS EXPERIMENT FOR MAPPING IRON COMPOUNDS, 1383
R. K. Vincent, Principal Investigator *In its* Process. and Analysis of ERTS-1 Remotely Sensed Data 15 Mar. 1973 9 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 (For availability see N73-20349 11-13)
(E73-10397) CSCL 08B

The author has identified the following significant results. Preliminary results of a spectral ratioing technique are shown for a region at the southern end of the Wind River Range, Wyoming. Digital ratio graymaps and analog ratio images have been produced for the test site, but ground truth is not yet

available for thorough interpretation of these products. ERTS-1 analog ratio images were found generally better than either ERTS-1 single channel images or high altitude aerial photos for the discrimination of vegetation from non-vegetation in the test site region. Some linear geological features smaller than the ERTS-1 spatial resolution are seen as well in ERTS-1 ratio and single channel images as in high altitude aerial photography. Geochemical information appears to be extractable from ERTS-1 data. Good preliminary quantitative agreement between ERTS-1 derived ratios and laboratory derived reflectance ratios of rocks and minerals encourage plans to use lab data as training sets for a simple ratio gating logic approach to automatic recognition maps. Empirical atmospheric corrections indicate that atmospheric corrections are needed to make the ratio method, and possibly other types of data processing, consistent over large geographical and temporal displacements.

N73-20360*# Nevada Univ., Reno. MacKay School of Mines.
COMPILE TWO PHOTOMAPS OF THE STATE OF NEVADA Progress Report
Joseph Lintz, Jr., Principal Investigator 23 Mar. 1973 2 p
(Contract NAS5-21864)
(E73-10398; NASA-CR-131134; PR-2) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-20361*# Alaska Univ., Fairbanks.
IDENTIFICATION, DEFINITION AND MAPPING OF TERRESTRIAL ECOSYSTEMS IN INTERIOR ALASKA Bimonthly Progress Report
James H. Anderson, Principal Investigator 31 Mar. 1973 9 p
(Contract NAS5-21833)
(E73-10399; NASA-CR-131135; BMPR-4) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. A transect of the Tanana River Flats to Murphy Dome, Alaska was accomplished. The transect includes an experimental forest and information on the range of vegetation-land form types. Multispectral black and white prints of the Eagle Summit Research Area, Alaska, were studied in conjunction with aerial photography and field notes to determine the characteristics of the vegetation. Black and white MSS prints were compared with aerial photographs of the village of Wiseman, Alaska. No positive identifications could be made without reference to aerial photographs or ground truth data. Color coded density slice scenes of the Eagle Summit Research Area were produced from black and white NASA aerial photographs. Infestations of the spruce beetle in the Cook Inlet, Alaska, were studied using aerial photographs.

N73-20362*# Alaska Univ., Fairbanks. Inst. of Water Resources.
BREAK-UP CHARACTERISTICS OF CHENA RIVER BASIN Bimonthly Progress Report
Robert F. Carlson, Principal Investigator 31 Mar. 1973 2 p
(Contract NAS5-21833)
(E73-10400; NASA-CR-131136; BMPR-4) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. Utilization of the color additive viewer was made to delineate snow boundary conditions from imagery taken during the fall snow accumulation period. By using filters that falsely colored the vegetation red, the snow cover appeared white.

N73-20363*# Alaska Univ., Fairbanks.
APPLICATION OF ERTS-1 IMAGERY TO THE STUDY OF CARIBOU MOVEMENTS AND WINTER DISPERSAL IN RELATION TO PREVAILING SNOWCOVER Bimonthly Progress Report
Peter C. Lent, Principal Investigator 31 Mar. 1973 3 p
(Contract NAS5-21833)
(E73-10401; NASA-CR-131137; BMPR-4) Avail: NTIS HC $3.00 CSCL 06C

The author has identified the following significant results. Preliminary analysis of false color composite imagery has indicated the feasibility of using ERTS-1 imagery to map botanical community types important as caribou range in northeast Alaska.

N73-20364*# Alaska Univ., Fairbanks.
CIRCULATION OF PRINCE WILLIAM SOUND Bimonthly Progress Report
Robin D. Muench, Principal Investigator 31 Mar. 1973 2 p
(Contract NAS5-21833)
(E73-10402; NASA-CR-131138; BMPR-4) Avail: NTIS HC $3.00 CSCL 08C

There are no author-identified significant results in this report.

N73-20365*# Alaska Univ., Fairbanks.
ERTS-A DATA AS A TEACHING AND RESEARCH TOOL IN THE DEPARTMENT OF GEOLOGY Bimonthly Progress Report
Donald Grybeck, Principal Investigator 1 Apr. 1973 4 p
(Contract NAS5-21833)
(E73-10403; NASA-CR-131139; BMPR-2) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. ERTS-1 prints have been used extensively in a geology of Alaska class to give a basic framework of the geology of the state. In addition, they have been intermittantly used in such diverse classes as: (1) Economic Geology (e.g. the Sn-bearing granites of the Seward Peninsula are particularly noticeable due to their wide contact metamorphic aureoles.) (2) A canned geology of Alaska lecture which has been given to two different introductory geology courses. (3) Structural Geology (e.g. the Fairweather and Denali faults are striking obvious). It was found most convenient for larger classes to prepare 35mm slides of the ERTS-1 prints that are used in conjunction with slides of the topographic and geologic maps at about the same scale. Thus the emphasis has been in integration of the ERTS-1 material into existing courses. As such, the ERTS-1 data has provided a unique and striking viewpoint that never fails to initiate favorable comment. In addition, prints have been examined by numerous researchers to develop a regional, integrated overview of such varied topics as regional geology to a background for local geologic mapping to studies of ore deposits and to the definition of a formation to be studied in detail at its type locality.

N73-20366*# Alaska Univ., Fairbanks.
GLACIOLOGICAL AND VOLCANOLOGICAL STUDIES IN THE WRANGELL MOUNTAINS, ALASKA Bimonthly Progress Report
Carl S. Benson, Principal Investigator 31 Mar. 1973 2 p
(Contract NAS5-21833)
(E73-10404; NASA-CR-131140; BMPR-4) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-20367*# Alaska Univ., Fairbanks.
EVALUATION OF FEASIBILITY OF MAPPING SEISMICALLY ACTIVE FAULTS IN ALASKA Bimonthly Progress Report
Larry Gedney, Principal Investigator 31 Mar. 1973 4 p
(Contract NAS5-21833)
(E73-10405; NASA-CR-131141; BMPR-4) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. The Yukon-Tanana uplands north and east of Fairbanks appear, on ERTS-1 imagery, to be composed of a number of large-scale (approximately 100 kilometers square) crustal blocks. The boundaries of these blocks appear to be defined by a number of northeast-striking lineaments which form the major river valleys of the area. Principal among these are the valleys of the Salcha River, the Cehan River, and the Chatanika River. These lineaments are all seismically active, and are thus presumed to be faults. This parallel set of lineaments appears to be intersected at various angles by a secondary set of faults trending generally north to south. The larger earthquakes in the area occur at the intersections of the two sets. It appears that seismicity of this part of Alaska may be conceptually represented by the grinding together of rigid blocks, with earthquakes occurring along their common boundaries and at the intersections where three or more blocks come in contact.

N73-20368*# Alaska Univ., Fairbanks.
FEASIBILITY STUDY FOR LOCATING ARCHAEOLOGICAL VILLAGE SITES BY SATELLITE REMOTE SENSING TECHNIQUES Bimonthly Progress Report

John P. Cook, Principal Investigator 31 Mar. 1973 8 p
(Contract NAS5-21833)
(E73-10406; NASA-CR-131142; BMPR-4) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Examination of NASA-provided aerial photography at the Pt. Hope, Alaska area has revealed numerous house pits, or the remains of former subterranean houses which have caved in. Although three major groupings of former house sites have previously been identified, a fourth area, north of the group known as Jabbertown had not previously been identified. It appears that this fourth site is quite extensive and may be of significance to understanding the sequence of habitation of the Pt. Hope location.

N73-20369*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
INVENTORY OF FOREST AND RANGELAND AND DETECTION OF FOREST STRESS Progress Report, 1 Jan. - 28 Feb. 1973
Robert C. Heller, Principal Investigator, Robert C. Aldrich, Frederick P. Weber, and Richard S. Driscoll 8 Mar. 1973 37 p ref
(NASA Order S-70251-AG)
(E73-10407; NASA-CR-131143; FS-1-3; PR-3) Avail: NTIS HC $4.00 CSCL 02F

The author has identified the following significant results. Three small scales of CIR photography were interpreted to determine the number of bark beetle-killed trees detected in each of six spot size categories. A procedure was developed to predict the probability of detecting spots in each spot size category and in turn to estimate the number of infestations and dead trees even on the smallest scale. Statistical tests of the data indicated that the linear model did not fit the data and that other models should be tested. As a result of daily monitoring of Black Hills radiometric instruments it was possible to show the spectral energy relationships in the ponderosa pine ecosystems over time. These data have been helpful for comparison with radiance signatures extracted from ERTS-1 bulk 70mm using precision microdensitometry. Effects of atmospheric interference were shown by a 30 percent increase in scene radiance on channel 4 of the satellite imagery. A calibration and scaling technique was developed and tested to enable interpretation of ERTS-1 bulk and precision data for the Atlanta test site. The technique includes calibration of a photographic copy system for the I2S image combiner and the production of scaled overlays of grid coordinate systems, study area locations, and outline maps of county boundaries.

N73-20370*# Agricultural Research Service, Weslaco, Tex.
REFLECTANCE OF VEGETATION, SOIL, AND WATER Progress Report, 19 Dec. 1972 - 19 Feb. 1973
Craig L. Wiegand, Principal Investigator 19 Feb. 1973 9 p
(NASA Order S-70251-AG)
(E73-10408; NASA-CR-131144) Avail: NTIS HC $3.00 CSCL 20N

The author has identified the following significant results. The ability to read the 24-channel MSS CCT tapes, select specified agricultural land use areas from the CCT, and perform multivariate statistical and pattern recognition analyses has been demonstrated. The 5 optimum channels chosen for classifying an agricultural scene were, in the order of their selection the far red visible, short reflective IR, visible blue, thermal infrared, and ultraviolet portions of the electromagnetic spectrum, respectively. Although chosen by a training set containing only vegetal categories, the optimum 4 channels discriminated pavement, water, bare soil, and building roofs, as well as the vegetal categories. Among the vegetal categories, sugar cane and cotton had distinctive signatures that distinguished them from grass and citrus. Acreages estimated spectrally by the computer for the test scene were acceptably close to acreages estimated from aerial photographs for cotton, sugar cane, and water. Many nonfarmable land resolution elements representing drainage ditch, field road, and highway right-of-way as well as farm headquarters area fell into the grass, bare soil plus weeds, and citrus categories and lessened the accuracy of the farmable acreage estimates in these categories. The expertise developed using the 24-channel data will be applied to the ERTS-1 data.

N73-20371*# Geological Survey, Denver, Colo.
A STUDY OF MORPHOLOGY, PROVENANCE, AND MOVEMENT OF DESERT SAND SEAS IN AFRICA, ASIA, AND AUSTRALIA Progress Report, 1 Jan. - 28 Feb. 1973
Edwin D. McKee, Principal Investigator 1 Mar. 1973 4 p refs
(NASA Order S-70243-AG-4)
(E73-10409; NASA-CR-131145) Avail: NTIS HC $3.00 CSCL 08M

There are no author-identified significant results in this report.

N73-20372*# Geological Survey, Washington, D.C.
ANALYSIS STUDY OF MULTISPECTRAL DATA, ERTS-A, FROM AN AREA IN WEST PAKISTAN Progress Report, 1 Jan. - 28 Feb. 1973
Robert G. Schmidt, Principal Investigator 7 Mar. 1973 3 p
(NASA Order S-70243-AG)
(E73-10410; NASA-CR-131146) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. Geomorphic features related to a known porphyry copper deposit at Saindak, western Chagai District, Pakistan, are easily distinguished on ERTS-1 images. New geologic information from the images was used in conjunction with known geology to evaluate one previously known prospect area and to suggest two additional ones, but no new prospects were recognized on the basis of the images alone. The study also showed that Saindak-type deposits are not likely to be present in some extensive areas of the Chagai District. The Saindak deposit is in an area of relatively easily eroded folded sedimentary and volcanic rocks. The deposit is characterized by an elongate zone of easily eroded sulfide-rich rock surrounded by a resistant rim of hornfels and propylitically altered rock. Both this rim and the central sulfide-rich valley are conspicuous features on the images. Swarms of dikes are probably useful for distinguishing real rims from other resistant rock types, but there is no expression of them on the image, although they are easily seen on aerial photographs of the Saindak rim. The investigation showed that a rim like that at Saindak does not form if regional metamorphism has increased the resistance of the country rock to erosion, as in the Pakistan-Iran border region northwest of Saindak.

N73-20373*# Bureau of Indian Affairs, Washington, D.C.
TIMBER RESOURCE INFORMATION SYSTEM Progress Report, 1 Jan. - 28 Feb. 1973
Arthur M. Woll, Principal Investigator 23 Mar. 1973 2 p
(NASA Order S-70243-AG-3)
(E73-10411; NASA-CR-131147) Avail: NTIS HC $3.00 CSCL 02F

There are no author-identified significant results in this report.

N73-20374*# Geological Survey, Menlo Park, Calif.
COASTAL ENVIRONMENT OF THE BEAUFORT SEA FROM FIELD DATA AND ERTS-1 IMAGERY, SUMMER 1972 Progress Report, 1 Jul. - 31 Dec. 1972
Erk Reimnitz, Principal Investigator and Peter W. Barnes 31 Dec. 1972 22 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(NASA Order S-70243-AG)
(E73-10412; NASA-CR-131148) Avail: NTIS HC $3.25 CSCL 08C

The author has identified the following significant results. An extensive field program during the spring and summer in the coastal Beaufort Sea test site has been completed using a wide variety of sensing techniques. Reduction of field data and ERTS-1 image analysis have shown the coastal environment to be complexly influenced by unique processes, most of which involve or are related to sea ice. Active sedimentologic processes along the Arctic coast are set in motion by the melting, flooding, and eventual overflow of rivers onto the sea ice. It is now apparent that only minor amounts of sediment are transported offshore at this stage; however, scouring of the bottom is significant beneath the strudels (drain holes) which develop in the fast ice canopy in the region of overflow. Areal salinity and turbidity patterns together with ERTS-1 imagery confirm a consistent influx of colder, clearer, saltier water towards the coast just east of the Colville River. Strong (up to 3 knots)

bidirectional but intermittent currents often manifest themselves in imagery and aerial photographs as wakes behind grounded ice. Ice movement vectors generated from repetitive images indicate that ice drift is closely associated with wind direction, especially in shallow bays, and displacements of 4-22 kilometers were noted in 24 hours.

N73-20375*# Oregon State Univ., Corvallis. Rangeland Resources Program.
INVENTORY AND MONITORING OF NATURAL VEGETATION AND RELATED RESOURCES IN AN ARID ENVIRONMENT Progress Report, 1 Sep. 1972 - 28 Feb. 1973
Barry J. Schrumpf, Principal Investigator, James R. Johnson, and David A. Mouat 20 Mar. 1973 48 p refs
(Contract NAS5-21831)
(E73-10413; NASA-CR-131149) Avail: NTIS HC $4.50 CSCL 08F

The author has identified the following significant results. A vegetation classification has been established for the test site (approx. 8300 sq km); 31 types are recognized. Some relationships existing among vegetation types and associated terrain features have been characterized. Terrain features can be used to discriminate vegetation types. Macrorelief interpretations on ERTS-1 imagery can be performed with greater accuracy when using high sun angle stereoscopic viewing rather than low sun angle monoscopic viewing. Some plant phenological changes are being recorded by the MSS system.

N73-20376*# Texas Instruments, Inc., Dallas.
ERTS-1 IMAGERY USE IN RECONNAISSANCE PROSPECTING: EVALUATION OF COMMERCIAL UTILITY OF ERTS-1 IMAGERY IN STRUCTURAL RECONNAISSANCE FOR MINERALS AND PETROLEUM Interim Report, 29 Aug. 1972 - 28 Feb. 1973
Donald F. Saunders, Principal Investigator, G. L. Thomas, and F. E. Kinsman Mar. 1973 32 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21796)
(E73-10414; NASA-CR-131150) Avail: NTIS HC $3.75 CSCL 08G

The author has identified the following significant results. Five areas in North America (North Slope - Alaska, Superior Province - Canada, Williston Basin - Montana, Colorado, and New Mexico - West Texas) are being studied for discernibility of geological evidence on ERTS-1 imagery. Evidence mapped is compared with known mineral/hydrocarbon accumulations to determine the value of the imagery in commercial exploration programs. Evaluation has proceeded in the New Mexico - Texas area, and to date, results have been better than expected. Clearly discernible structural lineaments in this area are evident on the photographs. Comparison of this evidence with known major mining localities in New Mexico indicates a clear pattern of coincidence between the lineaments and mining localities. In West Texas, lineament and geomorphological evidence obtainable from the photographs define the petroleum-productive Central Basin Platform. Based on evaluation of results in the New Mexico - West Texas area and on cursory results in the other four areas of North America, it is concluded that ERTS-1 imagery will be extremely valuable in defining the regional and local structure in any commercial exploration program.

N73-20377*# Stanford Research Inst., Menlo Park, Calif.
STUDY OF TIME LAPSE PROCESSING FOR DYNAMIC HYDROLOGIC CONDITIONS Progress Report, 6 Sep. 1972 - 6 Mar. 1973
Sidney M. Serebreny, Principal Investigator 26 Apr. 1973 9 p
(Contract NAS5-21841)
(E73-10415; NASA-CR-131151) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-20378*# Alaska Univ., Fairbanks.
SEA ICE AND SURFACE WATER CIRCULATION, ALASKAN CONTINENTAL SHELF Bimonthly Progress Report
Frederick F. Wright, Principal Investigator, G. D. Sharma, and J. J. Burns 29 Mar. 1973 18 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21833)
(E73-10416; NASA-CR-131154; BMPR-4) Avail: NTIS HC $3.00 CSCL 08L

The author has identified the following significant results. Sediments contributed by the Copper River in the Gulf of Alaska are carried westward along the shore as a distinct plume. Oceanic water relatively poor in suspended material appears to intrude near Montague Island, and turbid water between Middleton Island and Kayak Island is the result of Ekman between transport. An anticlockwise surface water circulation is observed in this region. Ground truth data indicate striking similarity with ERTS-1 imagery obtained on October 12, 1972. Observations of ERTS-1 imagery reveal that various characteristics and distribution of sea ice in the Arctic Ocean can be easily studied. Formation of different types of sea ice and their movement is quite discernible. Sea ice moves parallel to the cost in near shore areas and to the northerly direction away from the coast.

N73-20379*# Tennessee Univ., Knoxville.
EXTENT OF CYCLIC AND CHANGING ECOLOGICAL PHENOMENA AND SEMIPERMANENT VEGETATION ECOSYSTEM INTERFACES. ECOLOGICAL APPLICATIONS OF ERTS-A IMAGERY First Cook Report, 1 Oct. - 1 Dec. 1972
H. R. DeSelm, Principal Investigator 1 Dec. 1972 14 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21882)
(E73-10417; NASA-CR-131155) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-20380*# Kansas Univ./Center for Research, Inc., Lawrence. Remote Sensing Lab.
CENTER PIVOT IRRIGATION IN FINNEY COUNTY, KANSAS: AN ERTS-1 INTERPRETATION PROCEDURE
Donald L. Williams and Bonnie Barker Nov. 1972 14 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21822)
(E73-10418; NASA-CR-131208) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-20381*# Old Dominion Univ. Research Foundation, Norfolk, Va.
REMOTE DETECTION OF AEROSOL POLLUTION BY ERTS Semiannual Report, 4 Aug. 1972 - 31 Jan. 1973
G. E. Copeland, Principal Investigator, A. R. Bandy, E. C. Kindle, R. N. Blais, and G. M. Hilton 31 Jan. 1973 9 p
(Contract NAS5-21816)
(E73-10419; NASA-CR-131209) Avail: NTIS HC $3.00 CSCL 04B

The author has identified the following significant results. Photogrammetric and densitometric examination of ERTS-1 MSS imagery of eastern Virginia coupled with extensive ground truth air quality and meteorological data has shown that the identification and surveying of fixed particulate emitters (smoke plumes) is feasible. A description of the ground truth network is included. The quantitative monitoring of smoke stacks from orbital altitudes over state-size regions appears possible when tied to realistic plume models and minimal ground truth. Contrast reductions over urban areas can possibly be utilized to produce isopleths of particulates when supplemented by local measurements.

N73-20382*# Iowa Univ., Iowa City.
UTILIZING ERTS-A IMAGERY FOR TECTONIC ANALYSIS THROUGH STUDY OF THE BIGHORN MOUNTAINS REGION Progress Report, 15 Sep. 1972 - 15 Mar. 1973
Richard A. Hoppin, Principal Investigator 15 Mar. 1973 7 p
(Contract NAS5-21852)
(E73-10420; NASA-CR-131210) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Preliminary vegetation analysis has been undertaken on MSS

scene 1085-17294, Oct. 16, 1973 in the Bighorn region. Forest Service maps showing detailed distribution of dominant forest types have been compared with MSS bands 5 and 7 positive transparencies, enlarged positive prints, and color imagery produced on an Addcol viewer. Patterns on the ERTS imagery match those on the Forest Service maps quite well. A tectonic map overlay of MSS band 7 of the Bighorn region reveals a strong concentration of linears in the uplift as compared to basins. Folds in the Bighorn Basin are visible where not covered by post-Paleocene deposits. In regions where far less is known of the geology than in this area, it might be possible to predict the subsurface occurrence of folds and lineaments on the basis of imagery analysis and more confidently explore covered areas for concealed oil structures and mineral deposits.

N73-20383*# Colorado School of Mines, Golden. Dept. of Geology.
GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO Progress Report, 1 Feb. - 31 Mar. 1973
Daniel H. Knepper, Principal Investigator 28 Mar. 1973 8 p
(Contract NAS5-21778)
(E73-10422; NASA-CR-131212) Avail: NTIS HC $3.00 CSCL 08G

There are no author-significant results in this report.

N73-20384*# Brevard County Planning Dept., Titusville, Fla.
URBAN AND REGIONAL PLANNING PROPOSAL NO. Y-10-066-001 Progress Report, 1 Feb. - 31 Mar. 1973
John W. Hannah, Garland L. Thomas, and Fernando Esparza, Principal Investigators 31 Mar. 1973 18 p Original contains imagery. Original photography may by purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21847)
(E73-10423; NASA-CR-131213) Avail: NTIS HC $3.00 CSCL 13B

The author has identified the following significant results. An investigation is underway to determine the applicability of ERTS-1 data to urban and regional planning problems, using data for East Central Florida. Small scale land use mapping is feasible. Urban and commercial areas are sufficiently distinguishable that ERTS-1 appears to be a useful tool for monitoring urban and commercial growth. Development patterns of cities, growth patterns of cities, and distribution and changes in certain sectors within cities can be analyzed effectively. Digital analysis methods are proving useful.

N73-20385*# Old Dominion Univ. Research Foundation, Norfolk, Va.
INVESTIGATION TO RELATE CHLOROPHYLL AND SUSPENDED SEDIMENT CONTENT IN WATERS OF LOWER CHESAPEAKE BAY TO ERTS-1 IMAGERY Semiannual Report, 4 Aug. 1972 - 31 Jan. 1973
Peter Fleischer 31 Jan. 1973 6 p
(Contract NAS5-21816)
(E73-10424; NASA-CR-131214) Avail: NTIS HC $3.00 CSCL 08A

There are no author-identified significant results in this report.

N73-20386*# Wyoming Univ., Laramie. Remote Sensing Lab.
ANALYSIS OF ERTS-1 IMAGERY OF WYOMING AND ITS APPLICATION TO EVALUATION OF WYOMING'S NATURAL RESOURCES Bimonthly Report, Jan. - Feb. 1973
Ronald W. Marrs and Roy M. Breckenridge 26 Mar. 1973 10 p refs
(Contract NAS5-21799)
(E73-10425; NASA-CR-131215; ERTS-1-1-73A; BMR-3) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. The Wyoming investigation has progressed according to schedule during the Jan. - Feb., 1973 report period. A map of the maximum extent of Pleistocene glaciation was compiled for northwest Wyoming from interpretations of glacial features seen on ERTS-1 imagery. Using isodensitometry as a tool for image enhancement, techniques were developed which allowed accurate delineation of small urban areas and provided distinction of broad classifications within these small urban centers.

N73-20387*# Delaware Univ., Newark. Coll. of Marine Studies.
APPLICATION OF ECOLOGICAL, GEOLOGICAL AND OCEANOGRAPHIC ERTS-1 IMAGERY TO DELAWARE'S COASTAL RESOURCES PLANNING Progress Report, Jan. - Feb. 1973
V. Klemas 29 Mar. 1973 7 p refs
(Contract NAS5-21837)
(E73-10426; NASA-CR-131216) Avail: NTIS HC $3.00 CSCL 08A

The author has identified the following significant results. Communities containing four different coastal vegetation species, developed marshlands, and fresh water impoundments have been identified in ERTS-1 images. Ground measurements of suspended sediment load have been correlated with tonal variations in band 5.

N73-20388*# Dartmouth Coll., Hanover, N.H. Dept. of Geography.
LAND USE IN NORTHERN MEGALOPOLIS Progress Report
Robert B. Simpson, Principal Investigator 30 Mar. 1973 3 p
(Contract NAS5-21749)
(E73-10427; NASA-CR-13127; PR-5) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-20389*# Earth Satellite Corp., Berkeley, Calif.
INVESTIGATION TO DEVELOP A MULTISTAGE FOREST SAMPLING INVENTORY SYSTEM USING ERTS-1 IMAGERY Progress Report, Nov. 1972 - Jan. 1973
Philip G. Langley, Principal Investigator Jan. 1973 4 p
(Contract NAS5-21853)
(E73-10428; NASA-CR-131218) Avail: NTIS HC $3.00 CSCL 02F

The author has identified the following significant results. Two strips of U-2 RC-10 images were analytically triangulated and adjusted. Control points and pass points were marked on glass plates made from B&W copy negatives of IR color transparencies. A wild PUG-3 and TA1/p monocomparator were used to mark and measure the points on the glass plates. Each plate was measured twice in the same orientation for a check on accuracy and operator error. The 22 photographs were adjusted to 41 ground control and tie points and the block adjustment was performed in a secant plane coordinate system to eliminate the effect of earth curvature. Standard deviations of the residuals of the control and tie points were 12.8 m, 10.8 m, and 4.5 m for the X, Y, and Z coordinates respectively. The 12.8 m and 10.8 m figures correspond to an identification accuracy of 0.1 mm on the U-2 RC-10 plates. The standard deviations of the residuals encountered in the ERTS-1 resectioning were: (1) 0.16 mm assuming uncorrected perspective geometry and (2) 0.12 mm when the polynomial adjustment was added in. These results indicate a reduction of 0.11 in the square error due to the polynomial adjustment.

N73-20390*# Environmental Research Inst. of Michigan, Ann Arbor.
APPLICATION OF DIELECTRIC CONSTANT MEASUREMENTS TO RADAR IMAGERY INTERPRETATION
M. Leonard Bryan and R. W. Larson Mar. 1973 25 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21783)
(E73-10429; NASA-CR-131219; Rept-193300-4-S/J) Avail: NTIS HC $3.25 CSCL 17I

The author has identified the following significant results. Although it is readily recognized that there is a need for ground truth to provide adequate guidance for remote sensing data interpretation, it is noted that, in terms of radar remote sensing, this ground truth is often inadequate. It is necessary to make basic electrical and physical measurements of the surface and to some depth below it. A brief outline is presented of a ground truth scheme which uses measurements of the dielectric constant. Two portable instruments were designed specifically for this purpose; these were: (1) a Q-meter for measurement of dielectric constant and loss tangent; and (2) an instrument to measure electrical properties of the two operating frequencies of the imaging radar. Although extensive data are lacking, several general

cases of radar-earth surface and interaction are described; also, examples of radar imagery and some data on ice and snow are presented. It is concluded that the next logical step is to begin to quantify the radar ground truth in preparation for machine interpretation and automatic data processing of the radar imagery.

N73-20391*# Bendix Corp., Ann Arbor, Mich.
ECOLOGICAL EFFECTS OF STRIP MINING IN OHIO Bimonthly Progress Report, 1 Jan. - 1 Mar. 1973
Phillip E. Chase, Principal Investigator 1 Mar. 1973 4 p
(Contract NAS5-21762)
(E73-10430; NASA-CR-131220) Avail: NTIS HC $3.00 CSCL 08I

The author has identified the following significant results. ERTS-1 imagery has identified when reclamation has proved successful, when little lateral extension has occurred in the strip mine, when water has filled an impoundment (4 - 5 acres), and detected narrow contour mines. It has been proven that the CCT contains more information than the imagery received from NASA. A stream is visible in the band 7 digital printout that is not visible in the imagery. Also narrow bodies of water between the high wall and spoils bank and small impoundments (2 - 3 acres) are observed in the digital printout and not in the imagery. Disruption maps (water and bare earth within the mined area) can be made by statistically processing the CCT (decision imagery) or mapping the digital printout with a Bendix digitizer. Reclamation maps will be produced in the near future through decision imagery. There seems little doubt that the mapping of present stripping and the monitoring of the strip mine cycle for changes are practical. Disruption mapping is now an operational capability.

N73-20392*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
MAPPING OF THE MAJOR STRUCTURES OF THE AFRICAN RIFT SYSTEM Progress Report, 1 Jan. - 28 Feb. 1973
Paul Mohr, Principal Investigator 28 Feb. 1973 3 p refs
(Contract NAS5-21748)
(E73-10431; NASA-CR-131221) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Lake Tara lies within a previously recognized asymmetric graben situated on the Ethiopian plateau and about 250 km west of the plateau-Afar margin. ERTS-1 imagery confirms the stronger deformation of the western side of the Tara graben, with intense faulting and some associated monoclinal mapping extending between latitudes 12 deg and 14 deg N, and lying close to meridian 37 deg E. The zone of deformation is gently arcuate in plan, trending NNE in the south NNW in the north. In the north, the Quaternary faulting dies out in the alluvial plains of the Takazze Valley; in the south the faulting appears to die out in coincidence with a large erosional escapement trending S30W from Lake Tara to precisely latitude 11 deg N. This escapement aligns with the massive NE-SW escapement of western Simien, northeast of Lake Tara, and may represent erosional recession from major faulting and tilting much older than that of the superimposed, obliquely trending Tara graben. A 30 km diameter circular feature has been identified from the ERTS-1 imagery of the Tara graben, centered on 13 deg 05 min N, 37 deg 20 min E. ERTS-1 imagery further shows that the Tara graben and its associated young volcanics have no direct connection with the Red Sea or Ethiopian rift valley.

N73-20393*# Vermont Univ., Burlington. Dept. of Geology.
ENVIRONMENTAL STUDY OF ERTS-A IMAGERY LAKE CHAMPLAIN BASIN AND VERMONT Bimonthly Report, period ending 1 Mar. 1973
Aulis O. Lind, Principal Investigator 1973 4 p
(Contract NAS5-21753)
(E73-10432; NASA-CR-131222) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-20394*# Catholic Univ. of America, Washington, D.C. Research Inst. for Social and Behavioral Sciences.
[ANALYSIS OF ERTS IMAGERY OF AREA NORTH OF SEGOU, REPUBLIC OF MALI] Preliminary Report
Norman H. MacLeod, Principal Investigator [1973] 4 p ref
(Contract NAS5-21889)
(E73-10434; NASA-CR-131224) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-20395*# American Univ., Washington, D.C. Dept. of Biology.
[ANALYSIS OF ERTS IMAGERY OF OFFICE DU NIGER, REPUBLIC OF MALI] Preliminary Report
Norman H. MacLeod, Principal Investigator Feb. 1973 2 p
(Contract NAS5-21892)
(E73-10435; NASA-CR-131225; Rept-2) Avail: NTIS HC $3.00 CSCL 08F

There no author-identified significant results in this report.

N73-20396*# American Univ., Washington, D.C.
OBSERVATIONS OF THE PLANT GROWTH AND ANNUAL FLOODING IN THE INLAND DELTA OF THE NIGER RIVER, WEST AFRICA Bimonthly Report
N. H. MacLeod, Principal Investigator Apr. 1973 8 p
(Contract NAS5-21889)
(E73-10436; NASA-CR-131226; BMR-2) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. A large potential irrigation area with water delivery system in place was identified from ERTS-1 imagery. The site is in the Sahara Desert. Color additive change detection imagery was used to assess ground water potentials in the Savannah in conjunction with a major US AID-Mali livestock sector initiative. The potential capacity to map laterite deposits in the Inland Delta from space was established with the help of aerial and ground surveys. A color composite of the Inland Delta could have saved French biogeographers 3 5/6 man-years of professional field work had it been available, according to the man who prepared a plant community map of part of the southern Inland Delta.

N73-20397*# Ohio Dept. of Economic and Community Development, Columbus.
RELEVANCE OF ERTS TO THE STATE OF OHIO Progress Report, Jan. - Mar. 1973
David C. Sweet, Principal Investigator Mar. 1973 17 p Prepared for Battelle Columbus Labs. Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contracts NAS5-21782; BCL-72-17/G-1793)
(E73-10437; NASA-CR-131231) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-20398*# Alaska Univ., Fairbanks.
SURVEY OF THE SEASONAL SNOW COVER IN ALASKA Bimonthly Progress Report
Gunter Weller, Principal Investigator 31 Mar. 1973 4 p refs
(Contract NAS5-21833)
(E73-10438; NASA-CR-131232; BMPR-4) Avail: NTIS HC $3.00 CSCL 08L

The author has identified the following significant results. ERTS-1 data are used together with synoptic-climatological data to describe the buildup of the seasonal snow and ice covers in a north-south transect of a total length of about 1250 km across Alaska. It has been demonstrated that the ERTS-1 data may, under favorable conditions, be used for accurate mapping of snow lines in high mountain regions. The analysis shows that especially in the Brooks Range and on the Arctic Slope where snow covers generally are relatively thin, the ERTS-1 scenes can be useful for qualitative descriptions of the snow and ice covers over wide expanses. The onset and retreat of the seasonal snow cover are sensitive indicators of climatic fluctuations and the ERTS-1 data offers a possibility to record variations of the snow and ice buildup from year to year in a practical and informative way, which should be especially useful for studies of climatic trends. This is particularly true in Alaska where the density of the station network is too low to permit interpolations between the stations. A.L

N73-20399*# Alaska Univ., Palmer.
IDENTIFICATION OF PHENOLOGICAL STAGES AND VEGETATIVE TYPES FOR LAND USE CLASSIFICATION

Bimonthly Progress Report
C. Ivan Branton, Principal Investigator 5 Apr. 1973 30 p
(Contract NAS5-21833)
(E73-10439; NASA-CR-131233; BMPR-4) Avail: NTIS HC $3.50 CSCL 08F

The author has identified the following significant results. Multispectral reflectance signatures have been obtained from computer printouts from scene 1049-20505. Those signatures have been grouped for 13 dominant physical features in the Matanuska Susitna Valley area of Alaska. The derived signatures will be validated and tested by requesting another symbol-coded computer printout for the same area. It is expected that ERTS-1 imagery collected during late autumn and early spring will provide separations of signatures that are confounded in the 1049-20505 scene. Separating bogs and forests should be much improved when either snow covered or when grasses are brown. Photographs have been made of projections on the color additive viewer, each scene being projected with six different filter combinations. The products will be analyzed and those best suited used for producing color transparencies at a scale of 1:250,000 for overlaying on standard quadrangle maps. Color prints will be processed for use in the field. From digital MSS signatures derived to date, identification has been made of which bands are the most powerful for automated classification of dominant physical features. It has been found that separations among density ranges increase with longer wavelengths. Deriving MSS digital signatures has proven valuable to both digital and visual processing of ERTS-1 data.

N73-20400*# Natural Resources Management Corp., Berkeley, Calif.
INVESTIGATION OF THE DETECTION AND MONITORING OF FOREST INSECT INFESTATIONS IN THE SIERRA NEVADA MOUNTAINS OF CALIFORNIA Preliminary Data Analysis Report, 15 Dec. 1972 - 15 Feb. 1973
Ralph C. Hall, Principal Investigator 15 Feb. 1973 4 p
(Contract NAS5-21770)
(E73-10440; NASA-CR-131234) Avail: NTIS HC $3.00 CSCL 02F

There are no author-identified significant results in this report.

N73-20401*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF ERTS AND EREP IMAGES TO GEOLOGIC INVESTIGATIONS OF THE BASIN AND RANGE: COLORADO PLATEAU BOUNDARY IN NORTHWESTERN AND NORTH CENTRAL ARIZONA Progress Report, 15 Dec. 1972 - 15 Feb. 1973
A. F. H. Goetz, Principal Investigator, F. C. Billingsley, D. P. Elston (Geol. Surv., Flagstaff, Ariz.), I. Lucchitta (Geol. Surv., Flagstaff, Ariz.), and E. M. Shoemaker (Calif. Inst. of Tech., Pasadena) 26 Mar. 1973 10 p Sponsored by NASA
(E73-10441; NASA-CR-131235) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-20402*# Arizona Univ., Tucson. Dept. of Watershed Management.
USE OF EARTH RESOURCES TECHNOLOGICAL SATELLITE (ERTS) DATA IN A NATURAL RESOURCE INVENTORY Progress Report, 1 Oct. 1972 - 31 Mar. 1973
Ernest B. Fish, Principal Investigator 2 Apr. 1973 3 p
(Contract NAS5-21820)
(E73-10442; NASA-CR-131236) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-20403*# South Dakota State Univ., Brookings. Remote Sensing Inst.
EFFECTIVE USE OF ERTS MULTISENSOR DATA IN THE GREAT PLAINS Progress Report, period ending 31 Mar. 1973
Victor I. Myers, Principal Investigator 31 Mar. 1973 20 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21774)
(E73-10443; NASA-CR-131238) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. In the case of rangelands, manipulation of the digitized material from photographic recordings revealed that the mode-seeking program using only one vegetation group gave the best output map. Efficient mapping of this imagery will possibly require the use of narrow band filters. In the case of cropland, the results obtained with the K-class classifier are shown. Using one feature, the highest percent correct classification was obtained using band 6. Using two features, best results were obtained using bands 4 and 6 and 5 and 6. Specific results obtained with various bands are discussed. In the case of land systems, the eroded shale soils located along the Missouri River reservoirs in South Dakota above the Fort Randall and Big Bend Dams are clearly visible on the IR bands of ERTS scene 17 August, 1972, image description number 1025-16551. The appearance of various types of soil formations is described.

N73-20404*# Eason Oil Co., Oklahoma City, Okla.
AN EVALUATION OF THE SUITABILITY OF ERTS DATA FOR THE PURPOSES OF PETROLEUM EXPLORATION Progress Report, Feb. - Mar. 1973
Robert J. Collins, Principal Investigator 9 Apr. 1973 2 p
(Contract NAS5-21735)
(E73-10444; NASA-CR-131239) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-20405*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
UTILIZATION OF ERTS-1 DATA TO MONITOR AND CLASSIFY EUTROPHICATION OF INLAND LAKES Bimonthly Progress Report, 1 Feb. - 1 Apr. 1973
Phillip E. Chase, Principal Investigator 1 Apr. 1973 6 p
(Contract NAS5-21810)
(E73-10445; NASA-CR-131240) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. Bands 6 and 7 have fine structure as obtained by proper selection of digital levels in processing the CCT's. This is contrary to the imagery density received. This means that the small lakes can be classified in IR for different types of water masses. At least four distinct water masses have been determined for test lakes. They are shoreline, shallow water, and two deep waters. One deep water is patchy and presents difficulty in training set selection. The excellent weather and a completely successful field test form a significant happening. It required 12 orbits over the test area before perfect weather occurred.

N73-20406*# Rockwell International Science Center, Thousand Oaks, Calif.
IDENTIFICATION AND INTERPRETATION OF TECTONIC FEATURES FROM ERTS-1 IMAGERY Progress Report, 1 Feb. - 31 Mar. 1973
Monem Abdel-Gawad, Principal Investigator 9 Apr. 1973 3 p
(Contract NAS5-21767)
(E73-10446; NASA-CR-131241) Avail: NTIS HC $3.00 CSCL 08E

The author has identified the following significant results. The spatial relation of mercury deposits and faults in California coast ranges suggests regional structural control whereby the transverse faults and associated zones of weakness provided easy conduits for the ascent of hydrothermal solutions and emplacement of mercury ore. If proved valid, this relation identifies transverse fault zones as favorable structural guides for mercury exploration.

N73-20407*# Environmental Research and Technology, Inc., Lexington, Mass.
MAPPING ARCTIC SEA ICE FROM THE EARTH RESOURCES TECHNOLOGY SATELLITE
James C. Barnes, Principal Investigator and Clinton J. Bowley 9 Apr. 1973 19 p refs Submitted for publication Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21802)
(E73-10447; NASA-CR-131242) Avail: NTIS HC $3.00 CSCL 08L

The author has identified the following significant results. Methods of detecting ice and for distinguishing between ice and clouds are discussed, and examples of ERTS-1 data showing ice distributions in northern Hudson Bay, M'Clure Strait, the eastern Beaufort Sea, and the Greenland Sea are presented. The results of the initial analysis of ERTS-1 data indicate that the locations of ice edges and ice concentrations can be accurately mapped, and that considerable information on ice type can be derived through use of the various spectral bands. Ice features as small as 80 to 100 m width can be mapped.

N73-20408*# Wisconsin Univ., Madison. Environmental Monitoring and Data Acquisition Group.
EVALUATION OF THE APPLICATION OF ERTS-1 DATA TO THE REGIONAL LAND USE PLANNING PROCESS Progress Report, period ending 1 Apr. 1973
James L. Clapp, Principal Investigator 1 Apr. 1973 50 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21754)
(E73-10448; NASA-CR-131243) Avail: NTIS HC $4.50 CSCL 08F

There are no author-identified significant results in this report.

N73-20409*# Arizona Univ., Tucson.
EVALUATION OF ERTS-1 IMAGE SENSOR SPATIAL RESOLUTION IN PHOTOGRAPHIC FORM Progress Report
Philip N. Slater, Principal Investigator and R. A. Schowengerdt Mar. 1973 49 p refs
(Contract NAS5-21849)
(E73-10449; NASA-CR-131249; PR-3) Avail: NTIS HC $4.50 CSCL 14F

The author has identified the following significant results. A coherent optical system was used to display the spatial frequency content of the amplitude image of one area of the ground as obtained in the four wavelength bands of the multispectral scanner. This enabled a rapid comparison to be made between the four bands, from which it was clear that bands 5 and 7 were preferred to the others in terms of image definition, and thus mapping and acreage estimation, for the particular agricultural area imaged. With suitable scaling it was also possible to compare the modulation, as a function of spatial frequency, of MSS bands 4 and 5 with the green (BB) and red (DD) bands of the same area from the Apollo 9, SO65 experiment. A significant result is that the modulation in the MSS amplitude imagery is 65%-90% of that in the Apollo 9 amplitude imagery. In addition, the ratio of spatial frequencies for the ERTS-1 and Apollo imagery, at which the same modulation occurs, lies between 0.55 and 0.75 for the red band. This ratio is closely related to the ratio of resolutions for the two sensors. These values corroborate statements that the resolution of the MSS imagery is better than anticipated by pre-flight predictions.

N73-20410*# Nevada Univ., Reno. Max C. Fleischman Coll. of Agriculture.
USE OF SATELLITE IMAGERY FOR WILDLAND RESOURCE EVALUATION IN THE GREAT BASIN Progress Report
Paul T. Tueller, Principal Investigator Mar. 1973 18 p
(Contract NAS5-21870)
(E73-10450; NASA-CR-131250) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Upon receipt of ERTS-1 imagery, scale and resolution determinations were made. It was found that the scale was quite close to the anticipated 1:1 million, and that each ERTS-1 frame had a coverage of approximately 12,500 square miles. A water body 275 feet across was identified on the MSS 7 band as a determination of maximum resolution. Large cities were easily distinguished on all bands. Paved highways and railroads were able to be identified when there was extreme contrast between these structures and surrounding areas. Landforms were identified on all bands, but band 5 proved superior. Vegetation of varying types was identified using band 7. Fields and agricultural areas were identified as was phreatophytic vegetation. Timber, pinyon-juniper, sagebrush, mountain brush, and annual grassland communities were identified on selected frames. Phenology comparisons of selected test sites were made using sequential U-2 imagery. It was found that gray scale and color IR changes relating to the phenology of certain annual grassland, mountain brush, and marsh communities could be identified. Water bodies were identified and delineated using band 7.

N73-20411*# California Univ., Riverside. Citrus Research Center.
EVALUATION OF REMOTE SENSING IN CONTROL OF PINK BOLLWORM IN COTTON Progress Report, Feb. - Mar. 1973
Lowell N. Lewis, Principal Investigator and Virginia B. Coleman 10 Apr. 1973 6 p
(Contract NAS5-21771)
(E73-10452; NASA-CR-131251) Avail: NTIS HC $3.00 CSCL 02C

There are no author-identified significant results in this report.

N73-20412*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
STUDIES OF IMAGES OF SHORT LIVED EVENTS USING ERTS DATA Progress Report, Sep. 1972 - Feb. 1973
William A. Deutschman, Principal Investigator Mar. 1973 6 p
(Contract NAS5-21858)
(E73-10453; NASA-CR-131252) Avail: NTIS HC $3.00 CSCL 14E

The author has identified the following significant results. The program to study short-lived events with the ERTS-1 satellite has evaluated 97 events reported by the Center for Short-Lived Phenomena. Forty-eight of these events were listed as candidates for ERTS-1 coverage and 8 of these were considered significant enough to immediately alert the ERTS operation staff by telephone. Studies of the images received from six events indicate that useful data on short-lived events can be obtained from ERTS-1 that would be difficult or impossible to obtain by other methods.

N73-20413*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
PRELIMINARY EVALUATION OF THE 15 OCTOBER 1972 ERTS-1 IMAGERY OF EAST CENTRAL OHIO (SCENE 1034-15415)
Wayne A. Pettyjohn, Principal Investigator (Ohio State Univ.) Apr. 1973 19 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21762)
(E73-10454; NASA-CR-131254; BSR-3661) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. Results of a general, physical interpretation of ERTS-1 imagery of east central Ohio are presented. Special emphasis is placed upon geologic features, such as linear features and hydrologic features. Man-made features are included as a matter of interest and image location. The interpretation is compared to available maps of the area and from this an assessment that ERTS-1 is potentially useful for updating and producing geological maps.

N73-20414*# Texas Technological Univ., Lubbock. Dept. of Geosciences.
DYNAMICS OF PLAYA LAKES IN THE TEXAS HIGH PLAINS Progress Report, Oct. 1972 - Mar. 1973
C. C. Reeves, Jr., Principal Investigator 31 Mar. 1973 13 p
(Contract NAS5-21720)
(E73-10455; NASA-CR-131255) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. ERTS-1 MSS imagery has been ftound useful for taking a regional wet census of the tens of thousands of lake basins on the Southern High Plains, Texas and New Mexico. Once the ground truth which has been correlated with the MSS imagery, is correlated with CCT data, and reliable computer classifications are determined, a lake census from CCT printouts will be possible. Correlation of satellite imagery products with water fluctuations and water budget is also underway.

N73-20415*# Maine Dept. of Transportation, Augusta.
TO DEVELOP A LAND USE PEAK RUNOFF CLASSIFICATION SYSTEM FOR HIGHWAY ENGINEERING PURPOSES Progress Report
Ernest G. Stoeckeler, Principal Investigator 1 Apr. 1973 3 p

(Contract NAS5-21772)
(E73-10456; NASA-CR-131256; PR-5) Avail: NTIS HC $3.00 CSCL 13B

There are no author-identified significant results in this report.

N73-20416*# New York State Museum and Science Service, Albany.
TO EVALUATE ERTS-1 DATA FOR THE USEFULNESS AS A GEOLOGICAL SENSOR IN THE DIVERSE GEOLOGICAL TERRANES OF NEW YORK STATE Progress Report, period ending 15 Apr. 1973
Yngvar W. Isachsen, Principal Investigator 15 Apr. 1973 11 p
(Contract NAS5-21764)
(E73-10457; NASA-CR-131257) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. The straight NNE-trending escarpment that marks the easternmost extent of the Catskill Mountains appears, from ERTS-1 imagery (1079-15124) to be related to a set of parallel topographic lineaments which occur over a distance of 40 km to the west. The October 11 imagery of the Adirondacks (1080-15174) displays the pre-Paleozoic erosion surface along the western and northern margin of the Adirondack Mountains dome. The northern portion of this paleoplain is terminated to the southeast by an escarpment following an ENE topographic linear to produce a pseudo-cuesta. The snow covered terrain in the Mohawk Valley between Albany and Rome (1170-15182 and 1169-15123) displays with sculptural clarity a drumlin field having a cloud-free area of about 2600 sq km; glacial flow directions can be plotted readily because the stoss and lee sides of the drumlins can be distinguished. In the imagery of summer and fall, agricultural patterns obscured the detail which is visible in the winter imagery.

N73-20417*# Alaska Univ., Fairbanks.
COORDINATION AND ESTABLISHMENT OF CENTRALIZED FACILITIES AND SERVICES FOR THE UNIVERSITY OF ALASKA ERTS SURVEY OF THE ALASKAN ENVIRONMENT Bimonthly Progress Report
Albert E. Belon, Principal Investigator 31 Mar. 1973 8 p
(Contract NAS5-21833)
(E73-10459; NASA-CR-131259; BMPR-4) Avail: NTIS HC $3.00 CSCL 14B

There are no author-identified significant results in this report.

N73-20418*# Mississippi State Univ., State College. Dept. of Electrical Engineering.
STUDY OF THE APPLICATION OF REMOTE SENSING DATA TO LAND USE PLANNING ON THE MISSISSIPPI GULF COAST Progress Report
Frank Ingels, Principal Investigator 6 Apr. 1973 4 p
(Contract NAS5-21817)
(E73-10460; NASA-CR-131260) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-20419*# Kansas Univ./Center for Research, Inc., Lawrence. Remote Sensing Lab.
LAND USE CLASSIFICATION USING TEXTURE INFORMATION IN ERTS-A MSS IMAGERY
Robert M. Haralick, Principal Investigator, K. Shanmugam, and Robert Bosley Jan. 1973 30 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21822)
(E73-10461; NASA-CR-131261; TR-2262-1) Avail: NTIS HC $3.50 CSCL 08B

The author has identified the following significant results. Preliminary digital analysis of ERTS-1 MSS imagery reveals that the textural features of the imagery are very useful for land use classification. A procedure for extracting the textural features of ERTS-1 imagery is presented and the results of a land use classification scheme based on the textural features are also presented. The land use classification algorithm using textural features was tested on a 5100 square mile area covered by part of an ERTS-1 MSS band 5 image over the California coastline. The image covering this area was blocked into 648 subimages of size 8.9 square miles each. Based on a color composite of the image set, a total of 7 land use categories were identified. These land use categories are: coastal forest, woodlands, annual grasslands, urban areas, large irrigated fields, small irrigated fields, and water. The automatic classifier was trained to identify the land use categories using only the textural characteristics of the subimages; 75 percent of the subimages were assigned correct identifications. Since texture and spectral features provide completely different kinds of information, a significant increase in identification accuracy will take place when both features are used together.

N73-20420*# Wisconsin Univ., Milwaukee. Air Pollution Analysis Lab.
THE USE OF ERTS-1 SATELLITE DATA IN GREAT LAKES MESOMETEOROLOGICAL STUDIES Progress Report
Walter A. Lyons, Principal Investigator 30 Nov. 1972 10 p
(Contract NAS5-21736)
(E73-10464; NASA-CR-131271) Avail: NTIS HC $3.00 CSCL 04B

The author has identified the following significant results. In the original proposal, it was hoped that ERTS could, with its extremely high resolution and multispectral capability, detect many meteorological phenomena occurring at the low end of the mesoscale motion spectrum (1 - 100 km). This included convective cloud phenomena, internal wave patterns, air pollution, snow squalls, etc. For meteorologists, ERTS-1 has more than lived up to initial hopes. First-look inspection of images has produced a large number of truly remarkable finds. Some of the most significant are: (1) Images of Lake Ontario during late summer have revealed several extremely good examples of lake breeze frontal cloud patterns. (2) Detection of suspended particulates from Chicago-Gary industrial complex in the 50,000 to 150,000 tons/year category. (3) Inadvertant weather modification due to anthropogenic condensation and ice nuclei from urban areas. areas.

N73-20421*# Arizona Univ., Tucson. Dept. of Biological Sciences.
DETERMINATION OF SPECIES Progress Report
Charles H. Lowe, Principal Investigator and D. Slaymaker 12 Feb. 1973 2 p
(Contract NAS5-21819)
(E73-10466; NASA-CR-131273; PR-2) Avail: NTIS CSCL 08F

There are no author-identified significant results in this report.

N73-20422*# Poitiers Univ. (France). Lab. de Physique de la Haute Atmosphere.
THE PLASMAPAUSE PERIOD OF MAGNETIC RECOVERY. COMBINED STUDY OF OGO 4, OGO 5 DATA AND OF GROUNDED WHISTLER RECEPTION
P. Corcuff, Y. Corcuff, D. L. Carpenter (Stanford Univ.), C. R. Chappell (Lockheed Missiles and Space Co., Palo Alto, Calif.), J. Vigneron (Groupe de Rech. Ionospheriques), and N. Kleimenova (Inst. de Phys. de la Terre, Moscow) 13 Apr. 1972 44 p refs In FRENCH; ENGLISH summary
(Contract NAS5-9092; Grants NGL-05-020-008; NGR-05-020-288; NSF GV-28840X; NSF GA-18128; NSF GA-32590X)
(NASA-CR-131394) Avail: NTIS HC $4.25 CSCL 04A

The equatorial structure and dynamics of the plasmasphere during the period of magnetic recovery, lasting from the 13 to 23 of September 1968, are studied. The H(+) ions density profiles measured in the night and afternoon sectors by the excentered orbital satellite OGO 5 and L sub p positions of the plasmapause deduced from the VLF records of the polar orbital satellite OGO 4, are included. Electron densities are calculated from the whistlers received at Kerguelen (L approximately 3, 7) and Byrd (L approximately 7), ground stations 150 degrees of longitude apart. Author

N73-20423*# Biospherics, Inc., Rockville, Md.
AIRBORNE MICROWAVE RADIOMETRIC DATA ANALYSIS Final Report
22 May 1972 46 p
(Contract NAS5-21674)
(NASA-CR-130204) Avail: NTIS HC $4.50 CSCL 08M

Results from the 1.5 cm, 19.35 GHz electrical scanning microwave radiometer which was one of the instruments used

during the 1971 flight over Imperial Valley, California; Phoenix, Arizona; and Weslaco, Texas. Author

N73-20424*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

LOCKHEED PALO ALTO RESEARCH LABORATORY CONTRIBUTION TO THE 1973 UNITED STATES REPORT TO COSPAR

20 Dec. 1972 5 p

(Contracts NAS5-23106; NAS5-11360; NASw-1834)

(NASA-CR-130197; LMSC-D312279) Avail: NTIS HC $3.00 CSCL 04A

Research progress in particles and fields is summarized, including studies on auroral helium ions and protons, auroral electrons, and OGO-5 data analysis on magnetosphere. Upper atmospheric physics and solar and stellar astronomy are also considered. J.A.M.

N73-20425*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.

THE PHOTOLYSIS OF CH3ONO

H. A. Wiebe and Julian Heicklen 23 Jun. 1972 33 p refs

(Grant NGL-39-009-003)

(NASA-CR-131355; PSU-IRL-SCI-393) Avail: NTIS HC $3.75 CSCL 04A

The photolysis of CH3ONO, alone and in the presence of NO, NO-N2 mixtures, and NO-CO mixtures was studied between 25 and 150 C. The major products are CH2O, N2O, and H2O. The quantum yields of N2O were measured. The N2O yield is large at low pressures but approaches a high-pressure limiting value of 0.055 at all temperatures as the excited CH3O produced in the primary step is stabilized by collision. In the presence of excess CO, and N2O yield drops, and CO2 is produced (though not in sufficient amounts to account for the drop in N2O). When pure CH2ONO is photolyzed, CO is produced and NO accumulates in the system. Both products are formed in related processes and result from CH3O attack on CH2O. Author

N73-20426*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.

QUENCHING OF THE FLUORESCENCE OF NO2

Silvia Braslavsky and Julian Heicklen 5 Sep. 1972 44 p refs

(Grant NGL-39-009-003)

(NASA-CR-131296; PSU-IRL-SCI-398) Avail: NTIS HC $4.25 CSCL 04A

The fluorescence yield of NO2 was monitored at 25 C with incident wavelengths of 4047, 4358, and 4800A at fluorescence wavelengths of 4860, 5577, and 6300A. The NO2 pressure was varied between 0.004 and 0.080 torr. Measurements were taken both in the absence of foreign gases and in the presence of up to 30 torr. He, N2, and O2 at each NO2 pressure. In the absence of foreign gases, the self quenching follows a Stern-Volmer quenching mechanism, but foreign-gas quenching shows marked deviations from this mechanism. Both from lifetime and kinetic considerations, it is argued that the electronic state formed by absorption of the radiation cannot be the emitting state. Emission occurs from several vibrational levels of the emitting state, the various vibrational levels being formed by collisional cascade reactions. The appropriate quenching rate constant ratios were measured and tabulated. Even the two electronic state mechanisms are insufficient to explain all the observations. Author

N73-20427*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.

NEUTRAL ATMOSPHERIC MODELS COMPATIBLE WITH SATELLITE ORBITAL DECAY AND INCOHERENT SCATTER MEASUREMENTS

James Lee Rohrbaugh 7 Nov. 1972 74 p refs

(Grant NGL-39-009-003; Contract N00014-67-A-0385-0017)

(NASA-CR-131294; PSU-IRL-SCI-402) Avail: NTIS HC $5.75 CSCL 04A

A correlation study was made of the variations of the exospheric temperature extrema with various combinations of the monthly mean and daily values of the 2800 MHz and Ca:2 solar indices. The phase and amplitude of the semi-annual component and the term dependent on Kp were found to remain almost the same for the maximum and minimum temperature. The term dependent on the 27 day component of the solar activity was found to be about four times as large for the diurnal maximum as for the minimum. Measurements at Arecibo have shown that temperature gradient changes at 125 km are consistent with the phase difference between the neutral temperature and density maxima. This is used to develop an empirical model which is compatible with both the satellite measurements and the available incoherent scatter measurements. A main feature of this model is that day length is included as a major model parameter. Author

N73-20428# National Aeronautical Establishment, Ottawa (Ontario).

MEASUREMENTS OF THE STATISTICAL PROPERTIES OF ATMOSPHERIC TURBULENCE AT ALTITUDES BELOW 1000 FEET

D. G. Gould and J. I. MacPherson Jan. 1973 70 p refs

(LR-567) Avail: NTIS HC $5.50

Measured statistical properties of the three components of turbulence are presented for research flights at four altitudes below 1000 feet over flat terrain and two altitudes below 1000 feet over hilly terrain. The measured power spectral density distributions were closely approximated by the von Karman spectral shape. The derived scales of the three components were all about the same, being approximately proportional to height over the flat terrain. The derived scales at the higher altitudes appeared to be related to the terrain a considerable distance up-wind from the track along which the measurements were made. A comparison of the present results with those from the U.S. Air Force sponsored LO-LOCAT measurements showed good general agreement with the exception that the intensities at the higher wind velocities were significantly greater than those of the LO-LOCAT studies. Author

N73-20429# Ludwig-Maximilians-Universitat, Munich (West Germany).

A COMPARISON BETWEEN MEASURED TRANSMISSION AND EMISSION SPECTRA AND CALCULATED SPECTRA IN THE 9.6 MU REGION OF OZONE

D. Marzoch Jan. 1973 52 p refs In GERMAN; ENGLISH summary

(BMFT-FBW-73-01) Avail: NTIS HC $4.75; ZLDI Munich: 10.80 DM

Measurements of the atmospheric transmission and emission are compared with the calculated spectra obtained from theoretical line parameters. The comparison shows that the use of these line data recently fitted to laboratory measurements leads to incorrect results. Spectra computed with the latest released theoretical line data compare well with transmission measurements made from the ground. However, there remains a noticeable discrepancy in comparison with IRIS spectra obtained from the U.S. satellite Nimbus 3. Author

N73-20430# Bonn Univ. (West Germany).

ON THE SEMIANNUAL DENSITY VARIATION IN THE THERMOSPHERE DURING THE PERIOD OF INCREASING SOLAR ACTIVITY

C. Wulf-Mathies Jan. 1973 99 p refs In GERMAN; ENGLISH summary

(BMFT-FBW-73-02) Avail: NTIS HC $7.00; ZLDI Munich: 20.80 DM

The semiannual density variation at thermospheric heights has been investigated by the analysis of orbital decay data of eight satellites with perigee heights between 250 and 500 km. The density data of all eight satellites yield the same phase for the semi-annual effect independent of height and geographical latitude. Combining the results with data from other authors it can be stated that the semiannual variation occurs with a constant phase throughout the whole solar cycle. No clear evidence for the dependence of the amplitude on the phase of the solar cycle has been found. All atmospheric models give an incomplete description of the semiannual effect. They underestimate the observed amplitudes considerably. Author

N73-20431# Bonn Univ. (West Germany).

A ROCKET-BORNE MASS SPECTROMETER EXPERIMENT WITH A CRYO-COOLED ION-SOURCE FOR DETERMINATION OF THE NEUTRAL ATMOSPHERE COMPOSITION

BETWEEN 85 AND 125 km ALTITUDE
T. G. Scholz, D. Offermann, and H. Jobst Feb. 1973 45 p refs In GERMAN; ENGLISH summary
(BMFT-FBW-73-03) Avail: NTIS HC $4.25; ZLDI Munich: 9.25 DM

Mass spectrometer measurement of the composition of the neutron atmosphere are extended downward to 85 km by the use of a modified version of a helium-cooled ion source. Preflight preparations included functional tests in a supersonic wind tunnel, countdown, and flight simulations of the cryo-system, as well as high-pressure calibration of the mass spectrometers with a number of gases and gas mixtures at ambient pressures of up to 0.1 torr. Low pressure calibration runs included ozone for the first time. Two Skylark rockets were launched successfully from Sardinia on 25 and 30 March 1972. The regular operation of all parts of the mass spectrometer experiment is demonstrated from pressure and temperature data received via telemetry, and altitude profiles of the electrometer signals are given for N2, O2, Ar, O, CO2, and O3. Author

N73-20432*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ROLE OF GAS-SURFACE INTERACTIONS IN THE REDUCTION OF OGO 6 NEUTRAL-PARTICLE MASS SPECTROMETER DATA
A. E. Hedin, B. B. Hinton (Mich. Univ., Ann Arbor), and G. A. Schmitt (Mich. Univ., Ann Arbor) Washington Mar. 1973 30 p refs
(NASA-TN-D-7239; G-1081) Avail: NTIS HC $3.00 CSCL 04A

Data obtained with the quadrupole mass spectrometer aboard the OGO 6 satellite show the effects of significant surface interaction processes, including nearly complete recombination of incoming atomic oxygen on the walls of the instrument antechamber plus absorption and desorption of oxygen and carbon monoxide. The observed data are fit by solving the time-dependent continuity equations accounting for production and loss of atomic oxygen, molecular oxygen, and (in the case of mass 28) carbon monoxide. The surface parameters that best fit the data are selected and applied to the determination of ambient densities and their estimated errors. Author

N73-20433*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF BOTTOM TOPOGRAPHY, EDDY DIFFUSIVITY, AND WIND VARIATION ON CIRCULATION IN A TWO-LAYER STRATIFIED LAKE
Richard T. Gedney, Wilbert Lick (Case Western Reserve Univ.), and Frank B. Molls Washington Mar. 1973 47 p refs
(NASA-TN-D-7235; E-7032) Avail: NTIS HC $3.00 CSCL 08H

The steady-state, wind-driven circulation is calculated in a stratified lake composed of two layers having uniform but unequal densities and eddy diffusivities. The position of the thermocline and the velocities in both layers are calculated from an asymptotic solution of the shallow lake equations when the Ekman number in the epilimnion (upper layer) is of order one but the ratio of hypolimnion (lower layer) to epilimnion eddy diffusivities is much less than one. Large differences in the thermocline shape and the velocities occur between the solution for uniform wind stress and the one for unit order wind stress gradients. For the latter solution the hypolimnion eddy diffusivity magnitude and the bottom topography have a large and important effect. Author

N73-20434# Coast Guard, Washington, D.C.
OCEANOGRAPHIC CONDITIONS IN THE NORTHERN BAFFIN BAY REGION, 24 JULY - 6 AUGUST 1970
Robin D. Muench Aug. 1972 120 p refs
(CG-373-54) Avail: NTIS HC $8.00

Physical oceanographic conditions observed in northern Baffin Bay during midsummer 1970 are described. Spatial distributions of temperature and salinity are discussed using vertical sections and horizontal plan views. Circulation is discussed with the aid of dynamic topographies, temperature-salinity analyses, and isentropic diagrams, with computed geostrophic volume transports included. The gross physical oceanographic conditions observed and compared with those of previous summers. Author

N73-20435*# General Electric Co., Philadelphia, Pa. Missiles and Space Div.
ERTS 1 FLIGHT EVALUATION Quarterly Report, 23 Jul. - 23 Oct. 1972
28 Nov. 1972 232 p refs
(Contract NAS5-21808)
(NASA-CR-130178; DOC-72SD4262) Avail: NTIS HC $13.75 CSCL 22C

Analyses are presented for the flight performance of ERTS-1 during the orbits 0 to 1300. Author

N73-20436*# Arizona Univ., Tucson. Office of Arid Lands Studies.
NATURAL RESOURCE INVENTORY FOR URBAN PLANNING UTILIZING REMOTE SENSING TECHNIQUES
Kennith E. Foster, Paul F. Mackey (City of Tucson), and Charles D. Bonham (Colo. State Univ.) Oct. 1972 18 p refs
(Grant NGL-03-002-313)
(NASA-CR-131279; OALS-Bull-3) Avail: NTIS HC $3.00 CSCL 14E

Remote sensing techniques were applied to the lower Pantano Wash area to acquire data for planning an ecological balance between the expanding Tucson metropolitan area and its environment. The types and distribution of vegetation are discussed along with the hydrologic aspects of the Wash. F.O.S.

N73-20437*# Linguistic Systems, Inc., Cambridge, Mass.
SPLITTING ALUMINOSILICATES WITH SILICATE BACTERIA
V. G. Aleksandrov, M. I. Ternovskaya, and R. N. Blagodyr Washington NASA Apr. 1973 13 p refs Transl. into ENGLISH from Vestn. Selskokhoz. Nauki (Moscow), v. 12, 1967 p 39-43
(Contract NASw-2482)
(NASA-TT-F-14870) Avail: NTIS HC $3.00 CSCL 08M

An experiment was conducted to demonstrate the ability of silicate bacteria to break down the aluminosilicate nucleus in soils and the subsequent liberation of potassium. The equipment and procedures used in the experiment are described along with the results obtained. D.L.G.

N73-20438*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOME NEW ASPECTS ON THE SUPERROTATION OF THE THERMOSPHERE
P. W. Blum and I. Harris Apr. 1973 32 p refs Submitted for publication
(NASA-TM-X-66222; X-621-73-94) Avail: NTIS HC $3.75 CSCL 04A

The rotational velocity of the thermosphere in excess of the earth's rotational velocity is investigated. It is shown that there exists in the thermosphere a small diurnal mean driving force in the eastward direction, a phenomenon which is considered to be relative to the 10% to 20% thermospheric superrotation. A critical review of this observation and a theoretical analysis of the force are presented which take into account both equinox and solstice conditions. It is concluded that the discrepancy between observations of the superrotation made so far and accompanying explanations can be resolved, as applied to the area of the lower height region, where the great majority of observations were made. J.M.M.

N73-20439*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DOWN-BUCKLNG OF A CORNER OF A DESCENDING PLATE
Barbara E. Lowrey Jan. 1973 10 p refs Submitted for publication
(NASA-TM-X-66212; X-592-73-43) Avail: NTIS HC $3.00 CSCL 08K

A model of the earth's crust is presented as a set of rigid crustal blocks in which the crust is consumed, compressed, or created only at the boundaries of the blocks. As such the trench boundary moves with respect to the colliding plates because of down-buckling at the corner of the descending plate. It is further shown that this mechanism requires plate consumption of the descending plate at a rate faster than the relative plate motion, which in turn causes infilling of the basin behind the arc to compensate for the increased destruction. It is demonstrated

that earthquake, heat flow, paleomagnetic, gravity anomaly, and geologic data derived from Japan and the Sea of Japan support the model. Author

N73-20440*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BEHAVIOR OF NITRIC OXIDE FORMED BY THE SPACE SHUTTLE IN THE MESOSPHERE
Igor J. Eberstein (Consultants and Designers, Inc., Greenbelt, Md.) and A. C. Aikin Mar. 1973 60 p refs
(NASA-TM-X-66215; X-625-73-78) Avail: NTIS HC $5.00 CSCL 04A

A numerical model of eddy diffusive transport of emitted gases from the space shuttle wake, including chemical reactions between the emitted constituents and the ambient atmosphere, has been constructed for 75 km altitude. The numerical methods involve explicit solution of the diffusion equation and Runge-Kutta method for the chemical reactions. The time required to reach background levels of nitric oxide concentration of 7 x 10 to the 7th power molecules/cc has been calculated. This relaxation time depends strongly on atmospheric conditions. Author

N73-20441*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEODETIC REFERENCE SYSTEMS FOR LONG PERIOD STUDIES IN EARTH PHYSICS
R. S. Mather Mar. 1973 34 p refs Presented at the GSFC 4th Astrodynamics and Geodynamics Conf., Greenbelt, Md., 23-24 Apr. 1973
(NASA-TM-X-66221; X-592-73-83) Avail: NTIS HC $3.75 CSCL 08E

A simple system of reference axes is defined for possible use in high precision geodetic studies over long periods of time for programs in earth physics. The proposed system is based on the gravitational and dynamic characteristics of the axis of rotation and the earth's center of mass as defined instantaneously at a given epoch. Techniques are outlined for its continuous representation over time intervals of significance for studies in earth physics. The relationship between the proposed system and the representation of extra-terrestrial objects using the celestial sphere concept is also discussed. Author

N73-20442*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
ELECTRIC FIELD AND PLASMA OBSERVATIONS IN THE MAGNETOSPHERE Progress Report
Donald A. Gurnett May 1972 40 p refs Presented at 1972 COSPAR Symp. on Critical Probl. of Magnetosphere Phys.
(Contracts NAS5-10625; NAS1-8141; NAS1-2973; Grants NGL-16-001-002; NGL-16-001-043; Contract N00014-68-A-0196-0003)
(NASA-CR-131419; U-of-Iowa-72-14) Avail: NTIS HC $4.00 CSCL 03B

Satellite-borne electric field measurements using the double probe technique have now provided a comprehensive survey of convection electric fields at low altitudes in the magnetosphere. The most prominent features of the convection electric fields are reversals located at high magnetic latitudes, with generally anti-sunward convection poleward and sunward convection equatorward of the electric field reversal location. On the day side of the magnetosphere the electric field reversal is observed to coincide with the equatorward boundary of the polar cusp. In the local afternoon and evening regions inverted V electron precipitation bands occur at or near the electric field reversal and in regions usually characterized by large fluctuations in the electric field. In the local midnight region strong convection electric fields have also been observed deep within the magnetosphere, near the equatorward boundary of the plasma sheet. Recent measurements of electric fields near the inverted V electron precipitation bands suggests that these events are associated with large electrostatic potential gradients along the geomagnetic field. Author

N73-20443# TRW Systems Group, Redondo Beach, Calif. Theoretical Physics Group.
ANALYTICAL STUDY OF MICROWAVE SEA BRIGHTNESS TEMPERATURES: A COMPOSITE SURFACE MODEL Final Report
Richard J. Wagner and Philip J. Lynch Dec. 1972 84 p refs
(Contract N00014-71-C-0240; NR Proj. 387-051)
(AD-753533; TRW-17608-6010-R0-00) Avail: NTIS CSCL 08/10

The second-order geometrical optics theory of rough surface emissivity and sea brightness temperatures is extended to lower microwave frequencies by the introduction of a composite surface model, in which the diffraction effects of surface structure smaller than a wavelength are explicitly included. Sea brightness temperatures are calculated for a range of microwave frequencies, both polarizations, all observation angles, and a variety of environmental parameters. The results are in good agreement with experiment. Author (GRA)

N73-20444# Ohio State Univ., Columbus. Dept. of Geodetic Science.
CONVERGENCE OF MOLOGENSKY'S SERIES
Helmut Moritz Sep. 1972 61 p refs
(Contract F19628-72-C-0120; AF Proj. 8607)
(AD-754251; DGS-183; AFCRL-72-0663; SR-4) Avail: NTIS CSCL 08/5

Mologensky's solution of the geodetic boundary-value problem consists in an asymptotic series expansion with respect to a parameter k. It is shown that this series converges for sufficiently small values of k. The method starts from an integral equation given by Brovar and uses a Neumann series solution of this equation; the norms of the occurring singular integral operators are suitably estimated. Author (GRA)

N73-20445# Massachusetts Univ., Amherst. School of Engineering.
SPECTRAL DEVELOPMENT OF WIND-GENERATED WATER WAVES IN A LABORATORY FACILITY
John P. Jacobson and Joseph M. Colonell Dec. 1972 86 p refs
(Contract N00014-68-A-0146; NR Proj. 200-016)
(AD-754113; UM-72-8) Avail: NTIS CSCL 08/3

Research was conducted to investigate the growth of wind-generated waves on a laboratory scale. Water surface fluctuations were recorded for spectral and statistical analysis at eleven fetches and for three different wind speeds. The growth rates of individual components of the wave spectrum were examined to determine their possible functional relationship to fetch. Three distinct stages of spectral component development were observed. Author (GRA)

N73-20446# Defense Mapping Agency Aerospace Center, St. Louis, Mo.
ANALYSIS OF SOVIET GEODETIC SATELLITE DATA
Donald J. Wareham Oct. 1972 34 p refs Supersedes ACIC-TR-72-4
(AD-754070; DMAAC-TR-72-4; ACIC-TR-72-4) Avail: NTIS CSCL 08/5

An investigation has been made of Soviet camera sites at Riga and Uzhgorod and the site at Helsinki, Finland to determine the geodetic quality of their optical satellite observations with respect to seven other co-observing camera sites in Western Europe. The primary objectives were to improve the geodetic coordinates of the two Soviet sites and the site at Helsinki with respect to the European Datum and to ascertain the quality of the instrumentation used at the Soviet sites. Results of the analysis with respect to the European Datum also revealed a change in geodetic height at Station Malvern, England. Adjustments made on the geocentric SAO Standard Earth II Datum support the findings of other investigators regarding a scale variance between satellite adjustments limited to the European area and those on the global, geocentric SAO Standard Earth II Datum. Author (GRA)

N73-20447# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
STUDY OF HIGH-ALTITUDE AIRCRAFT WAKE DYNAMICS. TASK 1: PROBLEM DEFINITION Final Report
H. Hoshizaki, R. J. Conti, L. B. Anderson, K. O. Redler, and J. W. Meyer Dec. 1972 207 p refs
(Contract DOT-OS-20082)
(AD-754918; DOT-TST-90-3) Avail: NTIS CSCL 04/1

The purpose of the High-Altitude Aircraft Wake Dynamics Study has been to investigate the chemically reacting wake of an aircraft flying at subsonic and supersonic velocity in the upper troposphere and stratosphere. This is of interest because of the effects these exhaust gases could have upon the chemical balance in the stratosphere. In the study, the chemical and fluid mechanical behaviors of important emission species were traced from the time the species exited the engine exhaust nozzle to the time aircraft-induced perturbations to the atmospheric environment were no longer important. The important features of chemically reacting aircraft wakes have been identified. The aircraft wake is modeled in terms of the jet regime (wake age approximately 10 sec) vortex regime (approximately 100 sec) and the wake dispersion regime (approximately 100 sec). The important thermochemical reactions were found to take place in the jet regime. GRA

N73-20448# Aerospace Corp., El Segundo, Calif. Lab. Operations.
OBSERVATIONS OF RING-CURRENT PROTONS AT LOW ALTITUDES Research Report, Apr. - Jul. 1972
Paul F. Mizera and J. Bernard Blake 12 Jan. 1973 24 p refs
(Contract F04701-72-C-0073)
(AD-754844; TR-0073(3260-20)-8; SAMSO-TR-72-317) Avail: NTIS CSCL 04/1

Variable intensities of geomagnetically trapped protons with energies between 12.4 keV to 500 keV were observed during times encompassing the magnetic storms on 20 March and 24 March 1969. These proton fluxes were measured for 1.0 - L - 1.1 near the magnetic equator, at local midnight with solid-state detectors and an electrostatic analyzer on the low-altitude satellite OV1-17. The OV1-17 observations of proton intensities with E = 200 keV are in substantial agreement with similar measurements taken with the AZUR satellite and reported recently by Moritz (Zeitschrift fur Geophysik, in press 1972). Further, the lower energy proton intensities, measured with OV1-17 instrumentation, support Moritz's suggestion that the source of these low-altitude protons is the ring current. GRA

N73-20449# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
THE USE OF ERTS-1 IMAGERY IN THE NATIONAL PROGRAM FOR THE INSPECTION OF DAMS
Harlan L. McKim, Thomas L. Marlar, and Duwayne M. Anderson Dec. 1972 23 p refs
(AD-754579; CRREL-SR-183) Avail: NTIS CSCL 13/2

ERTS-1 imagery can be useful in locating circular water bodies over 152 m (500 ft) in diameter. Dams on streams can be identified by an abrupt change in stream width. A linear termination on a water body is a reliable indication of a dam, particularly when it is inconsistent with the normal drainage pattern. Care must be exercised to avoid confusing cloud shadows with water bodies. However, the association of a cloud with its shadow usually can be accomplished since the sun angle is noted in the data given on each ERTS image. Author (GRA)

N73-20450# Avco-Everett Research Lab., Everett, Mass.
SEAWATER TEMPERATURE MEASUREMENT FROM RAMAN SPECTRA Interim Technical Report
Chin H. Chang and Lee A. Young Dec. 1972 52 p
(Contract N62269-73-C-0073; ARPA Order 2194)
(AD-753481) Avail: NTIS CSCL 08/10

Raman spectra of water have been measured in the laboratory using improved optical instrumentation. The linear depolarization ratio agrees well with results found in the literature. Various portions of the isotropic and anisotropic components of the Raman spectra can be identified with distinct structural species in liquid water. The model predicts that the depolarization will be most temperature dependent in the long-wavelength portion of the spectrum, as is demonstrated by the data. Author (GRA)

N73-20451# California Univ., Berkeley. Hydraulic Engineering Lab.
THE INTERACTION OF WAVES AND TURBULENCE IN WATER
John D. Skoda Jun. 1972 127 p refs
(Contract DACW72-68-C-0033)
(AD-754645; HEL-25-1) Avail: NTIS CSCL 08/3

The report investigates a system in which water waves are generated and propagated in a turbulent flow field. Growth of wind wave spectra and decay of monochromatic waves are considered. For monochromatic waves the turbulence in the water can greatly increase the rate of wave energy dissipation and that the data can be fitted by an equation with an eddy viscosity term proportional to the wave height, the phase speed of the waves, and the intensity of the larger scale turbulence. Growth of wind waves on turbulent water is faster than in still water; however, maximum wave height in turbulent water is always lower than in still water. Wave energy spectra at the longer fetches in turbulent water show more wave energy at low frequency and less at high frequency than those for still water. Turbulence in water alters the rate of transfer of energy from the wind to the waves, the maximum height allowed and the distribution of wave energy among the various frequencies. Author (GRA)

N73-20452# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
CARTOGRAPHIC SCANNER/PLOTTER
L. S. Childress, T. E. Gagnon, D. Gurwitz, D. R. Thompson, and A. Czajkowski Jul. 1972 43 p
(Contract DAAK02-71-C-0139; DA Proj. 4A6-63712-D-864)
(AD-754648; ETL-CR-72-12) Avail: NTIS CSCL 08/2

A Cartographic Scanner/Plotter was designed, built and delivered and a set of application programs were developed and delivered to provide USAETL with an experimental digital cartographic data processing capability for producing large area color separation map negatives. This report includes a brief summary of that activity, a description and discussion of some specific engineering items encountered during the project, and a summary of the performance test results. Author (GRA)

N73-20453# Woods Hole Oceanographic Institution, Mass.
ADVANCED MARINE TECHNOLOGY
A. E. Maxwell, Thomas C. Aldrich, Bruce P. Luyendyk, Robert D. Ballard, and Carl O. Bowin 30 Nov. 1972 72 p refs
(Contract N00014-71-C-0284; ARPA Order 293; NR Proj. 293-008)
(AD-754445; WHOI-72-90) Avail: NTIS CSCL 08/10

The report is a progress report for the period 1 August 1971 - 31 January 1972 on the following projects in advanced marine technology: submerged navigation and submersible instrumentation (development of precise navigation for a small submersible), handling and transfer at sea (use of energy absorbers in small boat and buoy handling alongside in rough weather), bottom reconnaissance and detailed site survey (use of submersible in geological mapping), near bottom magnetic studies using a deep submersible, near bottom gravity studies from a deep submersible, a self-contained deep sea rock drill, and development of equipment for use in deep ocean biological research (observation and collection under pressure of benthic biology). Author (GRA)

N73-20454# Ohio State Univ., Columbus. ElectroScience Lab.
ELECTROMAGNETIC PULSE SOUNDING FOR GEOLOGICAL SURVEYING WITH APPLICATION IN ROCK MECHANICS AND RAPID EXCAVATION PROGRAM Final Report, 24 Feb. 1971 - 23 Feb. 1972
David L. Moffatt and L. Peters, Jr. Sep. 1972 116 p refs
(Contract DI-BM-HO210042; ARPA Order 1579)
(AD-754847; ESL-3190-2) Avail: NTIS CSCL 08/7

Progress toward the development of an electromagnetic pulse sounding probe for the detection and delineation of geological anomalies, primarily in a hard rock medium, is reported. This report covers research performed on Contract HO210042 during the period 24 February 1971 to 23 February 1972. Analytical studies on design data for the probe and on the scattering by planar and spherical contrasts are summarized. Successful measurements made using a first generation version of the probe on conducting and dielectric cylindrical targets in a lossy overburden and on specific anomalies in a limestone medium are reported. Author (GRA)

N73-20455# Woods Hole Oceanographic Institution, Mass.
R/V KNORR CRUISE NO. 13, 7-21 OCTOBER 1970
Donald A. Moller Nov. 1972 32 p

(Contract N00014-66-C-0241; NR Proj. 083-004)
(AD-754796; WHOI-72-80) Avail: NTIS CSCL 08/10

KNORR 13 was a scheduled buoy cruise, made during October, 1970. The objective of the cruise was to deploy and recover instrumented deep-sea moorings. Buoy stations 343, 344, 345, 348, and 349 were recovered. Stations 352, 353, 354, and 355 were set. In addition, one mooring at 35 deg 44 min N, 70 deg 37 min W was recovered for the University of Rhode Island. Mooring work was performed at Sites D, J, and L and on the Continental Slope in position 39 deg 50 min N, 70 deg 56 min W. A topographic survey was made in the immediate area of a three-mooring array located on the Continental Slope. Hydrographic stations were taken along the 71 deg W meridian between 39 degrees N and 40 degrees N. A 23-hour CCTD station was made in position 39 degrees N, 71 degrees W. Surface plankton tows were made daily. Author (GRA)

N73-20456# Agency for International Development, Washington, D.C. Office of Science and Technology.
THE APPLICATION OF GEOCHEMICAL, BOTANICAL, GEOPHYSICAL, AND REMOTE SENSING MINERAL PROSPECTING TECHNIQUES TO TROPICAL AREAS (STATE OF THE ART AND RESEARCH PRIORITIES)
Nov. 1972 81 p refs
(PB-213230; TA/OST-72-13) Avail: NTIS HC $3.00 CSCL 08I

Both conventional and emerging new technologies for mineral prospecting are treated under the following major topical headings: geochemical prospecting, botanical prospecting, geophysical prospecting, and remote sensing. In addition to providing brief descriptions of various instruments and survey methodologies and their principal applications, approximate costs for basic instrumentation as well as for particular types of surveys have been estimated. Each section concludes with an identification of on-going research activities, research gaps, and priorities with respect to future research. Author (GRA)

N73-20457# Utah State Univ., Logan. Space Science Lab.
SMALL ROCKET INSTRUMENTATION FOR POLAR CAP ABSORPTION MEASUREMENTS
David A. Burt, L. Carl Howlett, and Ronald J. Bell Jul. 1972 108 p refs
(Contract F19628-70-C-0302; AF Proj. 7663)
(AD-754897; AFCRL-72-0460; SR-2) Avail: NTIS CSCL 04/1

During the two year period ending 31 March, 1972, ten small rocket payloads were developed and instrumented at the Space Science Laboratory, Utah State University, for the study of polar cap absorption events (PCA). These payloads are part of a continuing program for the development and improvement of small rocket measurements techniques and the investigation of PCA. Instruments were developed which measure electron, positive ion and ozone density, and proton flux. Seven of the ten payloads were launched from Thule, Greenland, and were highly successful. Results of this program have shown that small rockets are indeed a valuable tool for the study of ionospheric parameters. Author (GRA)

N73-20458# Scripps Institution of Oceanography, San Diego, Calif. Visibility Lab.
AIRBORNE MEASUREMENTS OF OPTICAL ATMOSPHERIC PROPERTIES, SUMMARY AND REVIEW Final Report, 1 Nov. 1969 - 31 Aug. 1972
Seibert Q. Duntley, Richard W. Johnson, and Jacqueline I. Gordon Nov. 1972 78 p refs
(Contract F19628-70-C-0054; AF Proj. 7621)
(AD-754898; SIO-Ref-72-82; AFCRL-72-0593) Avail: NTIS CSCL 04/1

The report summarizes a 3-year period of collecting optical atmospheric data in the daytime chiefly with airborne instruments. Nine field expeditions were made between November 1969 and August 1972 in various places in the United States and Europe, primarily during the spring and fall. Measurements were made in five spectral regions, as follows: three narrow band optical filters with mean wavelengths of 478, 664, and 785 nanometers, and two broad band sensitivities, one representing the S-20 multiplier phototube incorporating an ultraviolet rejection filter with a mean wavelength of 532 nanometers, the other representing the photopic response with a mean wavelength of 557 nanometers. Optical measurements included total scattering coefficient and sky and terrain radiance. These data were used to calculate natural irradiance on a horizontal plane surface, directional reflectance of terrain, atmospheric beam transmittance, path radiance, and directional path reflectance. The methods of data collection and data processing are reviewed, the resultant data bank described, and initial comparisons made between several of the field expeditions. Author (GRA)

N73-20459# Maryland Univ., College Park. Computer Science Center.
DETECTION OF SURFACE-SPECIFIC POINTS BY LOCAL PARALLEL PROCESSING OF DISCRETE TERRAIN ELEVATION DATA
Thomas K. Peucker and Emily G. Johnston Nov. 1972 31 p refs
(Contract F44620-72-C-0062; AF Proj. 9769)
(AD-753701; TR-206; AFOSR-72-2329TR) Avail: NTIS CSCL 08/6

The report describes several methods designed to detect pits, peaks, passes, ridges, ravines and breaks, given an array of samples, quantized terrain elevations. The methods all use local analysis of the data, they are parallel in the sense that the results at each point do not depend on results already obtained at other points. Author (GRA)

N73-20460# Naval Coastal Systems Lab., Panama City, Fla.
THE DIRECTIONAL ANALYSIS OF OCEAN WAVES: AN INTRODUCTORY DISCUSSION, SECOND EDITION
Carl M. Bennett Dec. 1972 88 p refs Supersedes NSRDL/PC-3472
(SR0040301; ZR0000101)
(AD-753825; NCSL-144-72; NSRDL/PC-3472) Avail: NTIS CSCL 08/3

An introductory discussion of the mathematics behind the directional analysis of ocean waves is presented. There is sufficient detail for a reader interested in applying the methods; further, the report can serve as an entry into the theory. The presentation is basically tutorial but does require a reasonably advanced mathematical background. Results of a program for the measurement of directional ocean wave bottom pressure spectra are included as an appendix. This second edition makes corrections to the first and adds some details of an iterative directional analysis method. Author (GRA)

N73-20461# Naval Intelligence Support Center, Washington, D.C. Translation Services Div.
AIRCRAFT GAMMA SURVEY OF ROCKS AND SOILS COVERED BY A NONACTIVE ABSORBER LAYER
13 Dec. 1972 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Fiz. Zemli (USSR), no. 12, 1971 p 47-55
(AD-755003; NISC-Trans-3378) Avail: NTIS CSCL 18/8

Aerial reconnaissance and Fourier analysis techniques were used to conduct a gamma survey of rocks and soils covered by nonactive radiation absorption layers. Author

N73-20462# Utah Univ., Salt Lake City. Dept. of Geological and Geophysical Sciences.
CRUSTAL STRUCTURE FROM A HIGH RESOLUTION SEISMIC REFRACTION PROFILE ACROSS THE BASIN AND RANGE-MIDDLE ROCKY MOUNTAINS TRANSITION ZONE Progress Report, 1 May 1971 - 30 Apr. 1972
R. B. Smith, L. W. Braile, G. R. Keller, and R. M. Welch 15 Dec. 1972 45 p refs
(Contract N00014-67-A-0325-0004)
(AD-753850) Avail: NTIS CSCL 08/7

A high-resolution seismic refraction profile using large open-pit quarry blasts as sources, has been recorded along a line which crosses the Basin and Range-Middle Rocky Mountains provinces boundary. Interpretation of these data and existing USGS refraction lines in the region indicates that crustal thickness and upper mantle P-wave velocity increase to the east of the boundary. The increase in crustal thickness does not occur at the boundary between physiographic provinces but begins about 50 km east of the Wasatch front. A crustal low velocity layer located between 10 and 15 km in depth is continuous from the Basin and Range province into the Middle Rocky Mountains. The velocity contrast

between the low velocity layer and the overlying granitic layer decreases to the east. Author (GRA)

N73-20463# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
[STRESSES, DYNAMICS, AND HEAT AND MASS BUDGETS OF ARCTIC SEA ICE] Annual Report, 1 Oct. 1971 - 30 Sep. 1972
Norbert Untersteiner, Gary A. Maykut, Phil E. Church, Seelye Martin, and David Bell 1 Dec. 1972 30 p refs
(Contract N00014-67-A-0103-0007; NR Proj. 307-252)
(AD-754118; AR-4) Avail: NTIS CSCL 08/12

The report summarizes research performed during the year 1 October 1971 - 30 September 1972. Research topics include: sea ice dynamics, heat and mass budget of Arctic sea ice, desalination, thermal and mechanical stresses in sea ice, radiation in ice, bearing capacity of floating ice sheets, and interaction of oil and ice in the Arctic. Author (GRA)

N73-20464# Pressman Enterprises, Lexington, Mass.
PROBLEM AREAS OF STRATOSPHERIC CHEMICAL DYNAMICS Interim Scientific Report, 23 Apr. - 1 Jun. 1972
Jerome Pressman May 1972 58 p refs
(Contract DOT-TSC-369)
(PB-213111; DOT-TSC-369-2) Avail: NTIS HC $3.00 CSCL 04A

Recommendations identifying areas for further necessary study of natural stratospheric chemical dynamics, and the perturbations that might be induced by the exhaust emissions of aircraft flying in the stratosphere are reported. Author (GRA)

N73-20465# Pressman Enterprises, Lexington, Mass.
SURVEY OF STRATOSPHERIC AIRCRAFT WAKE CHEMICAL DYNAMICS Interim Scientific Report
Jerome Pressman Jul. 1972 58 p refs
(Contract DOT-TSC-369)
(PB-213114; DOT-TSC-369-3) Avail: NTIS HC $3.00 CSCL 04A

Presented is a survey and critical evaluation of information pertaining to the stratospheric aircraft wake chemical dynamics including both the hydrodynamics and chemistry of the phenomenon. Author (GRA)

N73-20466# Pressman Enterprises, Lexington, Mass.
SURVEY OF STRATOSPHERIC CHEMICAL DYNAMICS Interim Scientific Report
Jerome Pressman Apr. 1972 83 p refs
(Contract DOT-TSC-369)
(PB-213126; DOT-TSC-369-1) Avail: NTIS HC $3.00 CSCL 04A

A survey and critical evaluation of information are reported pertaining to the natural stratospheric composition and chemical dynamics and to the perturbations that might be induced by the exhaust emissions of aircraft flying in the stratosphere. Author (GRA)

N73-20467# Office of Science and Technology, Washington, D.C.
THE FEDERAL OCEAN PROGRAM. THE ANNUAL REPORT OF THE PRESIDENT TO THE CONGRESS ON THE NATION'S EFFORTS TO COMPREHEND, CONSERVE, AND USE THE SEA
Apr. 1972 122 p refs
(PB-212634) Avail: NTIS MF $0.95; SOD HC $0.70 CSCL 13B

An important characteristic of the maturing ocean program is viewing efforts in the marine environment from the perspective of need for its abundant resources, as well as the necessity to search carefully into the consequences of all actions in its development. Author (GRA)

N73-20468# Naval Aerospace Medical Research Lab., Pensacola, Fla.
INTERCORRELATIONS AND SELECTED DESCRIPTIVE STATISTICS FOR 96 ANTHROPOMETRIC MEASURES ON 1549 NAVAL AVIATION PERSONNEL Medical Research Progress Report
William F. Moroney and Margaret J. Smith Oct. 1972 88 p refs
(AD-754780; NAMRL-1165; PR-2) Avail: NTIS CSCL 01/3

A previous report by the authors showed the need for cockpit designers to consider the correlations between anthropometric features when designing workspaces. It was proposed that both the correlations between anthropometric features and the normal bivariate distributions for specific correlations be made available to designers. The present report makes correlations between 96 anthropometric features available to designers. GRA

N73-20469# Naval Postgraduate School, Monterey, Calif.
A NUMERICAL MODEL DEPICTING A WIND-DRIVEN CIRCULATION IN AN OCEAN BASIN CONTAINING AN ISLAND M.S. Thesis
James Vincent Sullivan, Jr. Sep. 1972 88 p refs
(AD-754354) Avail: NTIS CSCL 08/3

A numerical model was developed depicting the wind-driven circulation in an ocean basin containing an island. This linear, barotropic, filtered model was utilized to test and evaluate the Hole Relaxation technique in preparation for future comparative studies with a free surface model and later incorporation in a multi-level world-ocean model with islands. Eight different data cases were studied to evaluate the model's ability to properly treat a variety of island sizes and locations. Author (GRA)

N73-20470# Scripps Institution of Oceanography, San Diego, Calif. Visibility Lab.
VOLUME SCATTERING FUNCTIONS FOR SELECTED OCEAN WATERS Final Technical Report
Theodore J. Petzold Oct. 1972 77 p
(Contract N62269-71-C-0676)
(AD-753474; SIO-REF-72-78) Avail: NTIS CSCL 08/10

The Visibility Laboratory has, under previous contract with the Naval Air Development Center (NADC), Warminster, Pennsylvania, developed and constructed two instruments to measure the volume scattering function of water. These two instruments, plus a transmissometer, were used during 1972 to gather data on the optical properties of various waters. It is the purpose of this final report to present the results obtained from these measurements. Three general types of water are covered: deep clear oceanic water (Tongue of the Ocean), nearshore ocean water (off southern California), and very turbid harbor water (San Diego Harbor). GRA

N73-20471# Ohio State Univ., Columbus. Dept. of Geodetic Science.
GEOPOTENTIAL COEFFICIENT BEHAVIOR TO HIGH DEGREE AND GEOID INFORMATION BY WAVELENGTH
Richard H. Rapp Aug. 1972 29 p refs
(Contract F19528-72-C-0120; AF Proj. 7600)
(AD-754236; DGS-180; AFCRL-72-0506; SR-2) Avail: NTIS CSCL 08/5

An improved model for representing anomaly degree variance behavior was determined using anomaly degree variances obtained from satellite derived potential coefficients and anomaly variance in 10, 5, 2, 1, deg and 5' blocks as estimated from terrestrial gravity information. Of the six models tested one equation was considered best for describing the anomaly degree variance. This equation yields anomaly degree variances that: (1) fit the observed anomaly degree variances better than those implied by the Kaula rule; and (2) whose sum converges to the point anomaly variance of approximately 1200 mgal squared, as opposed to a divergent summation of the anomaly degree variances implied by the Kaula rules. Two models describing potential coefficient behavior are used to estimate the root mean square geoid undulation by wavelength. Four wavelength types were defined: long wavelengths: l = 2 to 10; intermediate wavelenths l = 11 to 100; short wavelength: l = 101 to 1000; and very short wavelength: l = 1001 to infinity. By one representation of of potential coefficient behavior the intermediate wavelength geoid information was plus or minus 5.68m, the short wavelength, plus or minus 0.66m, and the very short wavelength plus or minus 0.05m. Author (GRA)

N73-20472# Ohio State Univ., Columbus. Dept. of Geodetic Science.
IMPROVED MODELS FOR ANOMALY COMPUTATIONS

FROM POTENTIAL COEFFICIENTS
Richard H. Rapp Sep. 1972 29 p refs
(Contract F19628-72-C-0120; AF Proj. 7600; OSURF Proj. 3368-B1)
(AD-754245; DGS-181; AFCRL-72-0602; SR-3) Avail: NTIS CSCL 08/5

The report considers three problems in the evaluating mean gravity anomalies from potential coefficients, or the formation of observation equations for gravity data for use in solutions combining satellite and gravimetric data. The first problem considered was the errors caused by not integrating sin (m)lambda, cos (m)lambda, and Legendre functions in the basic equations over a block. The second problem examined the accuracy of various equations used to compute anomalies from potential coefficients considering precise anomaly definition. Finally, the use of ellipsoidal harmonics for combination solutions is discussed with specific computational formulas being given. Author (GRA)

N73-20473# Office of the Secretary of Transportation, Washington, D.C.
CLIMATIC IMPACT ASSESSMENT PROGRAM: WORKSHOP ON COMPUTATIONAL MODELING OF THE ATMOSPHERE Final Proceedings
Robert L. Underwood Jul. 1972 116 p refs Workshop held at Asilomar, Pacific Grove, Calif., 11-14 Apr. 1972
(PB-212819; DOT-TST-90-1) Avail: NTIS HC $3.00 CSCL 04A

On 11-14 April 1972, the Department of Transportation sponsored a workshop on computational modeling of the atmosphere pertinent to assessment of possible climatic changes that might result from the projected 1985-1990 world high altitude aircraft fleet. These proceedings record the deliberations of the two separate workshop panels: the fluid dynamics modeling panel and the chemistry panel. Author (GRA)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N73-20474* National Aeronautics and Space Administration, Washington, D.C.
DISPLAY SYSTEM Patent
Anne W. Story, inventor (to NASA) Issued 30 Jan. 1973 7 p Filed 16 Jul. 1970 Supersedes N70-40019 (08 - 22, p 4127)
(NASA-Case-ERC-10350; US-Patent-3,714,624;
US-Patent-Appl-SN-55535; US-Patent-Class-340-27R) Avail: US Patent Office CSCL 09E

A situational display and a means for creating the display are disclosed. The display comprises a moving line or raster, on a cathode ray tube, which is disposed intermediate of two columns of lamps or intensifications on the cathode ray tube. The raster and lights are controlled in such a manner that pairs of lights define a line which is either tracked or chased by the raster in accordance with the relationship between the optimum and actual values of a monitored parameter.
Official Gazette of the U.S. Patent Office

N73-20475* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INFRARED HORIZON LOCATOR Patent
Antony Jalink, Jr., inventor (to NASA) Issued 30 Jan. 1973 7 p Filed 26 May 1971 Supersedes N72-21419
(NASA-Case-LAR-10726-1; US-Patent-3,714,432;
US-Patent-Appl-SN-146935; US-Patent-Class-250-83.3H; US-Patent-Class-250-231) Avail: US Patent Office CSCL 14B

A precise method and apparatus for locating the earth's infrared horizon from space that is independent of season and latitude is described. First and second integrations of the earth's radiance profile are made from space to earth with the second delayed with respect to the first. The second integration is multiplied by a predetermined constant R and then compared with the first integration. When the two are equal the horizon is located. Official Gazette of the U.S. Patent Office

N73-20476* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MATERIAL FATIGUE TESTING SYSTEM Patent
Paul J. Gilley, inventor (to NASA) Issued 6 Feb. 1973 4 p Filed 1 Dec. 1970 Supersedes N72-15432 (10 - 06, p 0772)
(NASA-Case-MFS-20673; US-Patent-3,714,821;
US-Patent-Appl-SN-94049; US-Patent-Class-73-90;
US-Patent-Class-73-91) Avail: US Patent Office CSCL 14B

A system for cyclicly applying a varying load to a material under test is described. It includes a load sensor which senses the magnitude of load being applied to a material, and, upon sensing a selected magnitude of loading, causes the load to be maintained for a predetermined time and then cause the system to resume cyclical loading.
Officieal Gazette of the U.S. Patent Office

N73-20477* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MICROMETEOROID ANALYZER Patent
Siegfried O. Auer, inventor (to NASA) Issued 6 Feb. 1973 12 p Filed 26 Mar. 1971 Supersedes N71-34382 (09 - 21, p 3427)
(NASA-Case-ARC-10443-1; US-Patent-3,715,590;
US-Patent-Appl-SN-128419; US-Patent-Class-250-83.3R; US-Patent-Class-250-83R) Avail: US Patent Office CSCL 14B

A system for measuring the direction of flight, velocity, charge, mass and chemical composition of micrometeoroids is presented. The analyzer includes two spaced arrays of interconnected capacitors and an ion detector. Electrodes are fastened to the edge of each array. Micrometeoroids impinge on the arrays and generate signals at the electrodes. The magnitude of the signals is a function of the impact location. Ions accelerated from one array are focused on an ion detector to provide a time-of-flight mass spectrometer. Official Gazette of the U.S. Patent Office

N73-20478* North American Rockwell Corp., Canoga Park, Calif. Power Systems Div.
DROPLET MONITORING PROBE Patent
James R. Baughman and Paul C Thys Issued 23 Jan. 1973 5 p Filed 23 Sep. 1970 Supersedes N72-15420 (10 - 06, p 0771) Sponsored by NASA
(NASA-Case-NPO-10985; US-Patent-3,712,132;
US-Patent-Appl-SN-74759; US-Patent-Class-73-194E;
US-Patent-Class-324-30R; US-Patent-Class-324-65P) Avail: US Patent Office CSCL 14B

A droplet monitoring system is disclosed for analysis of mixed-phase fluid flow in development of gas turbines. The system uses a probe comprising two electrical wires spaced a known distance apart and connected at one end to means for establishing a dc potential between the wires. A drop in the fluid stream momentarily contacting both wires simultaneously causes and electrical signal which is amplified, detected and counted.
Official Gazette of the U.S. Patent Office

N73-20479 National Lending Library for Science and Technology, Boston Spa (England).
A METHOD OF LINEARIZING THE CHARACTERISTICS OF A THERMISTOR ELEMENT, AND ITS APPLICATION
Yumi Numata [1972] 23 p refs Transl. into ENGLISH from J. Meteorol. Res. (Japan), v. 23, 1971 p 51-65
(NLL-M-22863-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The linearization of a thermistor element is described and a detailed example is given of designing a thermometer for a captive balloon. Conditions were found for varying the resistance to temperature by connecting a fixed resistor to a thermistor in parallel or series and for producing a linear relation between bridge output current variation. It is pointed out that the results obtained still contain some unsatisfactory aspects for providing a general solution. However, appropriate resistance values are shown to be obtainable by the method and equations given.
D.L.G.

N73-20480 National Lending Library for Science and Technology, Boston Spa (England).
THE ACQUISITION OF A COLOUR POSITIVE TV IMAGE FROM COLOUR NEGATIVE CINEFILM
S. V. Novakovskii et al 1972 16 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (USSR), v. 2, 1972 p 9-14
(NLL-DRIC-Trans-2835-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Methods are examined for the conversion of a color negative into a positive image on a picture tube to bring about a high quality, positive color TV image. Recommendations are given for application in TV broadcasting and for the production of color motion picture films. Author

N73-20481*# California Univ., La Jolla. Visibility Lab.
CIRCULAR CARRIER-FREQUENCY PHOTOGRAPHY FOR OBSERVING PHASE OBJECTS
D. E. Silva and Y. M. Hong [1972] 8 p refs
(Grant NGL-05-009-079)
(NASA-CR-130198) Avail: NTIS HC $3.00 CSCL 14E

A circular grating is photographed through a phase object which deforms the image of the grating lines. By superimposing these deformed lines with a master grating on photographic film, moire patterns are observed. These patterns are interpreted as fringes of constant radial derivative. Author

N73-20482# Committee on Science and Astronautics (U. S. House).
FOURTH ANNUAL REPORT OF THE NATIONAL SCIENCE BOARD
Washington GPO 1972 118 p refs Hearing before Comm. on Sci. and Astron., 92d Congr., 2d Sess., No. 21, 26 Apr. 1972
Avail: Comm. on Sci. and Astronaut

The social implications of governmental involvement in aerospace research and development are discussed. The testimony of various members of the National Science Board as to the advantages and disadvantages of increased governmental control in this discipline as well as in the other sciences is included. This testimony was aimed at a development of an up-to-date national technology policy to provide the most effective methods to ensure the continuation of top quality scientific research and development. J.M.M.

N73-20483*# National Academy of Sciences-National Research Council, Washington, D.C.
STAGNATION PRESSURE PROBE Patent Application
Michael J. Goodyer, inventor (to NASA) Filed 7 Sep. 1972 11 p Sponsored by NASA
(NASA-Case-LAR-11139-1; US-Patent-Appl-SN-287149) Avail: NTIS HC $3.00 CSCL 14B

A description is given of a method and apparatus for measuring the stagnation presence of supersonic velocity gas streams without the generation of shock waves which interfere with such measurements. The technique is insensitive to type of gas and Mach number and is particularly useful in the study of jet engine exhausts. NASA

N73-20484*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
ELECTRON-PROTON SPECTROMETER QUALITY ASSURANCE PROCEDURES FOR EQUIPMENT AND PARTS
P. Gleeson [1972] 8 p
(Contract NAS9-11373)
(NASA-CR-128853; EPS-434) Avail: NTIS HC $3.00 CSCL 14B

Quality control procedures are established for personnel who are concerned with receiving, storage, transfer, inspection, and use of flight or mission related hardware for the electron/proton spectrometer (EPS) program. While general guidelines, designed to cover all situations, exist, this document provides guidelines and procedures specifically designed to supplement the quality assurance activity on the EPS Program. It is the purpose of this document to insure that all equipment, parts and other hardware received and/or used in the EPS program meet or surpass the standards and requirements established by cognizant authorities. Author

N73-20485*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
SAFETY ASSESSMENT FOR EPS ELECTRON-PROTON SPECTROMETER
P. Gleeson Aug. 1971 9 p
(Contract NAS9-11373)
(NASA-CR-128851; EPS-425) Avail: NTIS HC $3.00 CSCL 14B

A safety analysis was conducted to identify the efforts required to assure relatively hazard free operation of the EPS and to meet the safety requirements of the program. Safety engineering criteria, principles, and techniques in applicable disciplines are stressed in the performance of the system and subsystem studies; in test planning; in the design, development, test, evaluation, and checkout of the equipment; and the operating procedures for the EPS program. Author

N73-20486*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
END-TO-END TEST OF THE ELECTRON-PROTON SPECTROMETER
B. L. Cash [1972] 46 p
(Contract NAS9-11373)
(NASA-CR-128852; EPS-955) Avail: NTIS HC $4.50 CSCL 14B

A series of end-to-end tests were performed to demonstrate the proper functioning of the complete Electron-Proton Spectrometer (EPS). The purpose of the tests was to provide experimental verification of the design and to provide a complete functional performance check of the instrument from the excitation of the sensors to and including the data processor and equipment test set. Each of the channels of the EPS was exposed to a calibrated beam of energetic particles, and counts were accumulated for a predetermined period of time for each of several energies. The counts were related to the known flux of particles to give a monodirectional response function for each channel. The measured response function of the test unit was compared to the response function determined for the calibration sensors from the data taken from the calibration program. Author

N73-20487*# McDonnell-Douglas Corp., Huntington Beach, Calif.
A DEVICE FOR MONITORING A CHANGE IN MASS Patent Application
Joseph P. Valinsky, inventor (to NASA) Filed 13 Mar. 1973 13 p Sponsored by NASA
(NASA-Case-MFS-21556-1; US-Patent-Appl-SN-340791) Avail: NTIS HC $3.00 CSCL 14B

A remotely operable device for detecting changes as they occur in the mass of a selected specimen is described. The device consists of a balance beam with a support at one end for receiving a specimen with a changing mass. The suspension system, including a flexure, supports the beam near its center of gravity for pivotal movement imparted proportionally by changes occurring in the mass of the specimen. Strain gages coupled with the flexure provide a readout indicative of the pivotal movement imparted to the beam.
Official Gazette of the U.S. Patent Office

N73-20488# National Bureau of Standards, Washington, D.C. Heat Div.
OPTICAL RADIATION MEASUREMENTS: THE IMPACT OF RADIOMETRY AND PHOTOMETRY AND THE ROLE OF NBS
Bruce Steiner Mar. 1973 56 p refs
(NBS-TN-594-4) Avail: SOD $0.80 domestic postpaid or $0.55 GPO Bookstore

The impact of radiometry and photometry on a number of problems of national concern and the role of NBS in the measurement aspect of those problems is studied. National problems covered include public health, public safety, the energy crises, meteorology, pollution, and agriculture; crime prevention, air surveillance, and space surveillance. Author

N73-20489# Communications Research Centre, Ottawa (Ontario).
MICROWAVE RADIOMETRY FOR SURVEILLANCE FROM SPACECRAFT AND AIRCRAFT
A. W. Adey Feb. 1972 30 p refs

(CRC-1231) Avail: NTIS HC $3.50

The status of current airborne and satellite remote-sensing programs based on microwave radiometers are reviewed. Details of instrumentation capabilities/limitations and outlines of some research areas and problems where these devices appear to have application are presented. A bibliography is included.

Author

N73-20490*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.

ELECTRON-PROTON SPECTROMETER: SUMMARY FOR CRITICAL DESIGN REVIEW

[1972] 402 p refs

(Contract NAS9-11373)

(NASA-CR-128814; EPS-473) Avail: NTIS HC $22.25 CSCL 14B

The electron-proton spectrometer (EPS) is mounted external to the Skylab module complex on the command service module. It is designed to make a 2 pi omni-directional measurement of electrons and protons which result from solar flares or enhancement of the radiation belts. The EPS data will provide accurate radiation dose information so that uncertain relative biological effectiveness factors are eliminated by measuring the external particle spectra. Astronaut radiation safety, therefore, can be ensured, as the EPS data can be used to correct or qualify radiation dose measurements recorded by other radiation measuring instrumentation within the Skylab module complex. The EPS has the capability of measuring and extermely wide dynamic radiation dose rate range, approaching 10 to the 7th power. Simultaneously the EPS has the capability to process data from extremely high radiation fields such as might be encountered in the wake of an intense solar flare. Author

N73-20491*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

TASK 2 OF THE ULTRAVIOLET SPECTROMETER EXPERIMENT S169 Final Report

M. E. Goss Feb. 1973 240 p refs

(Contract NAS9-11528)

(NASA-CR-128889; SDO/CMO-455) Avail: NTIS HC $14.00 CSCL 14B

The far ultraviolet spectrometer for the Apollo 17 lunar scientific mission was constructed to meet the specific requirements and technical specifications as directed by the National Aeronautics and Space Administration. The Ebert Scanning Monochromator (UVS) was derived from extensive experience in the development of a variety of Ebert scanning monochromators for experiments aboard rockets and satellites. This equipment has the capability to make quantitative measurements of the composition of the lunar atmosphere as seen from the Apollo 17 CSM in lunar orbit, and to study the spectra of a number of astronomical sources during trans-earth coast. Author

N73-20492*# Beckman Instruments, Inc., Anaheim, Calif. Advanced Technology Operations.

RESIDUAL WATER BACTERICIDE MONITOR DEVELOPMENT PROGRAM Final Report

23 Mar. 1973 117 p

(Contract NAS9-12733)

(NASA-CR-128884; FR-2639-102) Avail: NTIS HC $8.00 CSCL 14B

A silver-ion bactericidal monitor is considered for the Space Shuttle Potable Water System. Potentiometric measurement using an ion-selective electrode is concluded to be the most feasible of available techniques. Four commercially available electrodes and a specially designed, solid-state, silver-sulfide electrode were evaluated for their response characteristics and suitability for space use. The configuration of the solid-state electrode with its Nernstian response of 10 to 10,000 ppb silver shows promise for use in space. A pressurized double-junction reference electrode with a quartz-fiber junction and a replaceable bellows electrolyte reservoir was designed verification-tested, and paired with a solid-state silver-sulfide electrode in a test fixture. Author

N73-20493*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.

CALIBRATION OF THE ELECTRON-PROTON SPECTROMETER

B. L. Cash [1972] 58 p

(Contract NAS9-11373)

(NASA-CR-128850; EPS-956) Avail: NTIS HC $5.00 CSCL 14B

The principal function of the sensor used in the electron-proton spectrometer is to provide a signal which can be used to determine the energy and indicate the type of an incident particle. Two techniques are employed to resolve the particle intensity in different energy regions. The first employs a moderator surrounding each detector to provide a nominal lower limit to the energy of a particle which can be detected. The second technique utilizes a pulse height discriminator to identify those particles entering a detector whose energy is (1) sufficiently high that it exceeds the discriminator level if the particle is stopped in the detector, or (2) sufficiently low that the ionization rate causes the discrimination level to be exceeded for paths through the detector shorter than the particle range. Author

N73-20494# National Environmental Satellite Service, Washington, D.C.

RADIOMETRIC TECHNIQUES FOR OBSERVING THE ATMOSPHERE FROM AIRCRAFT

William L. Smith and Warren J. Jacob Jan. 1973 16 p refs Presented at Conf. on Atmospheric Radiation, Fort Collins, Colo., 7-9 Aug. 1972

(NOAA-TR-NESS-64) Avail: SOD $0.35 domestic postpaid or $0.25 GPO Bookstore

Radiometric observations were made from aircraft with spacecraft prototype instruments to test satellite remote sensing techniques. At the same time these observations were used to study the problem of remote sensing from aircraft because of its own particular value in providing data in the support of sub-synoptic scale meteorological experiments such as the forthcoming GARP Atlantic Tropical Experiment. Aircraft radiometric methods of obtaining clear column radiances, vertical temperature profiles, total precipitable water, and cloud heights and amounts are described. Questions regarding vertical resolution and accuracy specification as a function of aircraft altitudes are answered. Results obtained using observations made during June 1970 with prototype versions of the Nimbus-E ITPR aboard the NASA CV-990 are presented and discussed. It is concluded that multispectral radiometers aboard an aircraft can be effective meteorological observing tools. Author

N73-20495*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

APPLICATION OF AN ELECTRONIC IMAGE ANALYZER TO DIMENSIONAL MEASUREMENTS FROM NEUTRON RADIOGRAPHS

Alex Vary and Kenneth J. Bowles Mar. 1973 23 p refs Presented at Spring Meeting of the Am. Soc. for Nondestructive Testing, Los Angeles, Calif., 12-15 Mar. 1973

(NASA-TM-X-68200) Avail: NTIS HC $3.25 CSCL 14B

Means of obtaining improved dimensional measurements from neutron radiographs of nuclear fuel elements are discussed. The use of video-electronic image analysis relative to edge definition in radiographic images is described. Based on this study, an edge definition criterion is proposed for overcoming image unsharpness effects in taking accurate diametral measurements from radiographs. An electronic density slicing method for automatic edge definition is described. Results of measurements made with video micrometry are compared with scanning microdensitometer and micrometric physical measurements. An image quality indicator for estimating photographic and geometric unsharpness is described. Author

N73-20496*# University of South Florida, Tampa. Dept. of Astronomy.

OPTICAL FILTERING FOR STAR TRACKERS Final Report

Robert E. Wilson [1973] 149 p refs

(Grant NGR-10-008-009)

(NASA-CR-130199) Avail: NTIS HC $9.50 CSCL 20F

The optimization of optical filtering was investigated for tracking faint stars, down to the fifth magnitude. The effective wavelength and bandwidth for tracking pre-selected guide stars are discussed along with the results of an all-electronic tracker with a star tracking photomultiplier, which was tested with a simulated second magnitude star. Tables which give the sum of

zodiacal light and galactic background light over the entire sky for intervals of five degrees in declination, and twenty minutes in right ascension are included. F.O.S.

N73-20497*# Signatron, Inc., Lexington, Mass.
STUDY OF A WIDEBAND PROBE Final Report
Peter Alexander and Howard Salwen Jul. 1972 272 p refs
(Contract NAS5-21683)
(NASA-CR-130196; A-134) Avail: NTIS HC $15.75 CSCL 14B

The design of an experiment to measure communication characteristics of wideband satellite-to-ground links is reported. Of special concern are the effects of rainstorms and atmospheric turbulence on path attenuation and phase fluctuation. Multi-tone and pulse probing are considered. A multi-tone technique which is a modification of ATS-5 and ATS-F hardware is recommended. Data extraction and data processing techniques and key hardware requirements for the experiment are reviewed. Author

N73-20498*# California Univ., Los Angeles.
A SUMMARY OF THE RESULTS FROM THE UCLA OGO-5 FLUXGATE MAGNETOMETER Final Report, Feb. 1965 - Dec. 1972
Paul J. Coleman, Jr. and Christopher T. Russell Feb. 1973 42 p refs
(Contract NAS5-9098)
(NASA-CR-130205; IGPP-Publ-1173-18) Avail: NTIS HC $4.25 CSCL 14B

The OGO-5 fluxgate magnetometer experiment (E-14) was designed to measure the vector magnetic field over the full range of the OGO-5 orbit. Thus, it had a dynamic range of + or - 64,000 gamma yet it maintained a precision of + or - 1/16 gamma at all times. This enabled a broad spectrum of problems to be attached. Studies of the magnetospheric waves, currents, waves-particle interactions, pitch angle distributions and wave normal directions were made. The structure of the magnetopause, the magnetotail, and bow shock were probed, waves and discontinuities in the solar wind were examined and the various phases of substorms were examined in depth. Author

N73-20499# Advisory Group for Aerospace Research and Development, Paris (France).
AGARD FLIGHT TEST INSTRUMENTATION SERIES. VOLUME 2: IN-FLIGHT TEMPERATURE MEASUREMENTS
F. Trenkle, M. Reinhardt, W. D. Mace, ed., and A. Pool, ed. Feb. 1973 171 p refs
(AGARD-AG-160-Vol-2; AGARDograph-160-Vol-2) Avail: NTIS HC $10.75

The field of temperature measurements in aircraft at Mach numbers up to 2.3 and altitudes up to 80,000 feet is reported. After a general discussion of the requirements of aircraft temperature measurements, and the available temperature sensing technology, the detailed techniques of using resistance probes and thermocouples, as well as the associated electrical leads, circuits, and indicators, are explained. A discussion of heat transfer processes, primarily between moving fluids and solids, includes terminology, the systematics of temperature measurements, and the concept of total temperature as the main operational parameter. One section deals with errors in temperature measurements, as functions of various parameters, in gases, liquids and solids. Typical laboratory and in-flight calibration techniques for thermometery are described, followed by discussions of data handling, error analysis, and the limits of present methods. Author

N73-20500# Technische Universitaet, Brunswick (West Germany). Fakultaet fuer Maschinenbau und Elektrotechnik.
METHODS FOR MEASURING THE DYNAMIC PROPERTIES OF ELECTRICAL CONTACT THERMOMETERS [UEBER METHODEN ZUR MESSUNG DER DYNAMISCHEN EIGENSCHAFTEN VON ELEKTRISCHEN BERUEHRUNGSTHERMOMETERN]
Dieter Huhnke 1972 225 p refs In GERMAN
Avail: NTIS HC $13.25

The development and performance of an electrically heated bare wire grid for temperature measurements in flowing media is reported. This device provides for ideal heat measurements on air flows; it can also be used for water flows if the degree of turbulence and its effect on temperature measurements are considered. Transl. by G.G.

N73-20501# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali di Frascati.
TOROIDAL MAGNETIC FIELD SPECTROMETER FOR EXPERIMENTATION WITH HIGH ENERGY BEAMS
P. Spillantini 19 Jun. 1972 4 p refs Presented at ECFA Study Week on the 300 GeV Accelerator Conf., Tirrenia, Italy, 20-29 Sep. 1972 Submitted for publication
(LNF-72/59; Conf-720951-1) Avail: AEC Depository Libraries

Topics briefly discussed include the general characteristics for high energy reactions, toroidal magnetic field, and spectrometers with toroidal magnets. The main parameters for a general setup to be used for particles up to 200 GeV/c are given. NSA

N73-20502# Grenoble Univ. (France).
AUTOMATIC CONTROL AND RECORDING SYSTEM FOR AN IRONFREE pi(ROOT 2) MAGNETIC SPECTROMETER Ph.D. Thesis
G. Bertrand 1972 129 p refs In FRENCH
(FRNC-TH-268) Avail: AEC Depository Libraries

During modifications to the power supply of the pi root 2 ironfree magnetic spectrometers, it was decided to automate the control system. The basic automation unit is a PDP 8E computer. The interface and counters are described. The program developed enables the current to be programmed; the counters to be read, reset to zero, and set into action; the carrying out of certain calculations; the presentation of the results on a teletype unit and punched tape. It was demonstrated that an accuracy of 0.001 is obtained with an effective stability of 2 x 0.0001 with this unit. The preliminary results obtained on a study of multipolarities in the Te-129m yields Te-129 yields I-129 decay chain are presented. NSA

N73-20503# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
INFLUENCE OF SPACE RADIATION ON THE CACTUS ULTRASENSITIVE ACCELEROMETER Ph.D. Thesis - Paris Univ.
Jacques Tiffon 1972 56 p refs In FRENCH; ENGLISH summary
(ONERA-NT-200) Avail: NTIS HC $5.00

Operation of the Cactus accelerometer onboard the French D5-B satellite may be perturbed by the electric charge gathered by the proof mass under high energy radiation. It is shown that the charge effect is mainly due to protons and electrons in the Van Allen radiation belts. The various characteristics of proton and electron interaction processes with matter have led to separate studies of the effects of both particles on the level of proof mass electric charge. Periodic discharges of the proof mass are considered. The experimental results have made possible the determination of the discharge frequency. ESRO

N73-20504# Naval Research Lab., Washington, D.C.
DESIGN AND APPLICATIONS OF A HOLOGRAPHIC SYSTEM FOR CRYSTAL GROWTH STUDIES Summary Report
J. A. Blodgett and R. J. Schaefer 2 Jan. 1973 47 p refs
(AD-754737; NRL-7498) Avail: NTIS CSCL 14/5

Holography, with its unique depth of field and interferometric capabilities, is a powerful new tool for the study of crystal growth. This report describes the theory and practice of forming and reconstructing holograms as applied to the study of microscopic phenomena. It outlines the technical considerations involved in the design of a holographic laboratory and describes the type of experimental results which may be obtained. A holographic laboratory could employ several techniques of holographic microscopy, including holographic interferometry. In the holographic work at NRL an argon ion laser was used to record holograms of transparent organic analogs to solidifying metals. Special observation chambers were constructed to allow holographic recording of planar solid/liquid interfaces, dendrites, floating crystals, and liquid inclusions in crystals. Crystal morphologies were measured by interferometric analysis of the reconstructed holograms. Crystal imperfections were shown to initiate surface relief features. A 2-percent anisotropy of the

solid/liquid surface energy was found to control anisotropic crystal growth. Author (GRA)

N73-20505# State Univ. of New York, Syracuse. Coll. of Environmental Science and Forestry.
COORDINATE MEASUREMENT RESEARCH: BASIC AND APPLIED EXPERIMENTS WITH THE NEGATIVE-RETICLE CONCEPT Final Technical Report
Jonathan C. Hescock, Ronald P. Klotz, and Robert H. Brock Aug. 1972 204 p refs
(Contract DAAK02-71-C-0255)
(AD-753946; ETL-CR-72-14) Avail: NTIS CSCL 14/5

Experiments with the negative-reticle concept are extended on both the basic and applied levels. This concept utilizes a measuring mark which is as close to the negative of the target as possible. The result is maximum edge information and pointing stimulus. Part 1 of the study describes a basic measuring experiment which is conducted with an apparatus having a least count of 0.04 seconds of arc. The results showed a precision approaching 0.1 seconds of arc, and the experimental parameters from greatest to least concern were observer, target density, reticle density, target shape, observing illumination, and X and Y coordinate values. Part 2 of the study employed a standard comparator. Photographic images were measured with both a negative-reticle and a standard cross-reticle. The negative reticle yielded measurements which were more consistent and precise. Author (GRA)

N73-20506# Ballistic Research Labs., Aberdeen Proving Ground, Md.
DESIGN AND CALIBRATION OF A LARGE ASPECT ANGLE TOTAL HEAD PRESSURE GAGE
C. H. Hoover Oct. 1972 68 p refs
(DA Proj. 1T0-61102-A-33E)
(AD-755120; BRL-MR-2239) Avail: NTIS CSCL 14/2

A total head pressure gage that would give accurate data over an aspect angle of at least 30 degrees was designed for a height of burst study program. Shock tube and wind tunnel calibration tests were performed. The results give correction factors to be applied to field data for various aspect angles and Mach numbers. Author (GRA)

N73-20507# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLITAIRE CALIBRATION EXPERIMENT
Daniel D. Powlette 29 Dec. 1972 47 p refs
(Contract F19628-73-C-0002; AF Proj. 627A)
(AD-754944; TN-1972-42; ESD-TR-72-357) Avail: NTIS CSCL 17/5

The report gives the results of an experiment in which the mount angle readout system of an infrared, acquisition-tracking system (SOLITAIRE) was calibrated using an Air Force aircraft as a target. These angle data, which were obtained from a 15-bit digital shaft angle encoder system, are compared to angle data from several radars at White Sands Missile Range. Author (GRA)

N73-20508# Army Foreign Science and Technology Center, Charlottesville, Va.
CALCULATION OF ILLUMINATION FOR AERIAL SURVEY ON COLOR FILM
V. Ya. Mikhaitov and A. N. Uspenskii 14 Aug. 1972 11 p refs Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 11, 1969
(AD-754627; FSTC-HT-23-781-72) Avail: NTIS CSCL 14/5

In connection with the use of color films for aerial surveying, the Soviet Union occupies a leading position regarding the extent of territory photographed and the assortment range of films, the quality of images, and the efficiency of use of color aerial photographs for interpretation. In contrast to foreign practice, where aerial surveying is done in the main on reversible film, in the USSR the negative positive process is prevalent. A still further spread of color aerial photographs is limited by the light sensitivity of the film and the properties of the aerial photography apparatus used. From the practical point of view it is interesting to bring these factors into confrontation with the circumstances of daytime illumination with a view to determining the exploitational potentials of aerial color photography. Author (GRA)

N73-20509# Defense Documentation Center, Alexandria, Va.
INFRARED PHOTOGRAPHY Report Bibliography, Jan. 1954 - Apr. 1972
Jan. 1973 127 p refs
(AD-754600; DDC-TAS-72-77) Avail: NTIS CSCL 14/5

The bibliography comprises citations of unclassified reports dealing with infrared photography and infrared films. The following references are on some of the topics dealing with the subject: aerial surveying, planetary and lunar research, high speed recording with gallium arsenide light emitting diodes, thermal mapping, and technology of infrared radiation. Corporate Author-Monitoring Agency, Subject, Title, Personal Author, Contract, and Report Number Indexes are included. Author (GRA)

N73-20510*# Virginia Military Inst., Lexington. Research Labs.
PRECISION CLOSED BOMB CALORIMETER FOR TESTING FLAME AND GAS PRODUCING INITIATORS Final Report, Nov. 1971 - Sep. 1972
D. Rae Carpenter, Jr. and Arthur C. Taylor, Jr. Sep. 1972 103 p refs Sponsored in part by NASA
(Contract DAAG39-72-C-0042; HDL Proj. 913294)
(NASA-CR-131371; AD-754649; HDL-42-1) Avail: NTIS CSCL 14/2

A calorimeter has been developed under this study to help meet the needs of accurate performance monitoring of electrically or mechanically actuated flame and gas producing devices, such as squib-type initiators. A ten cubic centimeter closed bomb (closed volume) calorimeter was designed to provide a standard pressure trace and to measure a nominal 50 calorie output, using the basic components of a Parr Model 1411 calorimeter. Two prototype bombs were fabricated, pressure tested to 2600 psi, and extensively evaluated. Author (GRA)

N73-20511# Monsanto Research Corp., St. Louis, Mo.
AN EXPERIMENTAL TECHNIQUE FOR MONITORING DYNAMIC CRACKS
R. E. Lavengood, D. Peretz, F. L. Brissey, and E. M. Wu Oct. 1972 22 p refs
(Contract N00014-67-C-0218; ARPA Order 876; NR Proj. 356-484)
(AD-754762; HPC-70-126) Avail: NTIS CSCL 14/2

A technique is presented which, by means of plating and etching processes, permits the creation of a wide variety of crack propagation gages. High precision gages of arbitrary size and shape are easily prepared. Specific gage configuration is shown for center notch, edge notch and cleavage type specimens. Optimum gage design is discussed and typical readout circuits are shown. Author (GRA)

N73-20512# Ohio State Univ., Columbus. Dept. of Geodetic Science.
THE USE OF EDGES OF PHOTOGRAPHIC IMAGES AS SPECIFIERS OF IMAGE QUALITY Final Report, 1 Nov. 1970 - 15 Oct. 1972
Leon G. Thompson Nov. 1972 175 p refs
(Contract DAAK02-71-C-0122; OSURF Proj. 3147-A1)
(AD-753947; DGS-179; ETL-CR-72-15) Avail: NTIS CSCL 14/5

The primary objective of this study was to search for some measureable quantity which would specify the quality of an image with reference to a photogrammetrist's ability to measure to an edge. The image quality criterion was the closeness together of the edge determinations of four experienced observers who were asked to set a measuring mark tangent to a series of edges generated by rapidly rotating various patterns. An edge of high measuring quality was defined as any edge which rendered a high degree of agreement in edge determination and was measured by computing the standard deviation in edge location of the four observers. The second objective of studying where an observer determines the edge to be located was easily studied as a result of the many edge determinations required in ranking the edges as to image quality. A new term called decutance was derived which correlates very highly with the measured image quality. Author (GRA)

N73-20513# Naval Medical Research Inst., Bethesda, Md.
AN ERGOMETER FOR USE IN ALL HYPERBARIC ENVIRONMENTS Medical Research Progress Report

William E. Moritz and William H. Mints 20 Nov. 1972 21 p refs
(AD-754401; PR-4) Avail: NTIS CSCL 14/2

A simple ergometer has been designed and built which can be used to accurately measure stress divers in the various environments they normally encounter. The device is usable in both dry and wet environments including the open sea at all depths to which men have operated to date. It's size and weight make it easily portable and when the frame is partially disassembled it will fit through the vast majority of chamber hatches. The associated electronics and switching system virtually eliminate any ignition source that could cause a fire in an oxygen rich environment. The device has been used in a number of experiments by 9 subjects and has been readily accepted by them. A wide range of workloads are available ranging from 250 to 1400 kg-m/min. The design of the system minimizes the possibility of recording more work than the subject actually performs. The signalling/timing system provides a means of controlling the rate and duration of each work period from a remote location.

Author (GRA)

N73-20714 Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
ACTIVITIES OF LRBA IN THE INERTIAL DOMAINE [ACTIVITES DU LRBA DANS LE DOMAINE DE L'INERTIE]
Jean Moret and Guy Cally *In* AGARD Inertial Navigation Components and Systems Feb. 1973 12 p In FRENCH (For availability see N73-20684 11-21)

N73-20715 Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
DETERMINATION OF NONLINEAR ACCELEROMETERS BY A METHOD OF DIFFERENTIAL TESTS [DETERMINATION DES NON LINEARITES D'ACCELEROMETRES PAR UNE METHODE D'ESSAIS DIFFERENTIELS]
Jean Moret and Guy Cally *In* AGARD Inertial Navigation Components and Systems Feb. 1973 8 p In FRENCH (For availability see N73-20684 11-21)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N73-20514* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPARATUS FOR RECOVERING MATTER ADHERED TO A HOST SURFACE Patent
William W. Paik and Carl P. Chapman, inventors (to NASA) Issued 30 Jan. 1973 4 p Filed 7 Oct. 1970 Supersedes N71-33492 (09-20, p 3279) Sponsored by NASA
(NASA-Case-NPO-11213; US-Patent-3,713,987; US-Patent-Appl-SN-78703; US-Patent-Class-195-127) Avail: US Patent Office CSCL 13I

The development of an apparatus for removing and recovering matter adhered to a host surface is described. The device consists of a pickup head with an ultrasonic transducer adapted to deliver ultrasonic pressure waves against the material. The ultrasonic waves agitate the material and cause its separation from the surface. A vacuum system recovers the material and delivers it to suitable storage containers.

Official Gazette of the U.S. Patent Office

N73-20515 National Lending Library for Science and Technology, Boston Spa (England).
CARBON DIOXIDE SHIELDED-ARC WELDING WITH ELECTRODES CONTAINING ALUMINIUM
S. Moria, K. Ishizaki, and T. Nishi 4 Dec. 1972 12 p ref Transl. into ENGLISH from Yosetsu Gakkaishi (Tokyo), v. 39, no. 2, Feb. 1961 p 120-125
(NLL-CE-Trans-6011-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Eight kinds of Si-Mn steel electrodes and high-Al steel electrodes were manufactured for testing. High-Al and high-Si-Mn electrodes produced sound welds on semikilled steel plates using carbon dioxide gas. Oxygen content of all weld metals obtained from high-Al electrodes were lower than that obtained from Si-Mn electrodes. The mechanical properties of all weld metals are given. By using two kinds of high-Al electrodes, it was possible to make quality welds on 12 mm semikilled steel plates with three kinds of joint preparation.

Author

N73-20516 National Lending Library for Science and Technology, Boston Spa (England).
THE INFLUENCE OF STEAM ON THE DEPTH OF FUSION WITH ELECTRON-BEAM WELDING
U. P. Adler and E. L. Mamootov 4 Dec. 1972 9 p refs Transl. into ENGLISH from Elektron. Orrab. Mater. (USSR), v. 3, no. 39, 1971 p 15-18
(NLL-DRIC-Trans-2927-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The influence of the interaction of an electron beam with the cloud of steam above the welding pool on the depth of concentrated fusion was investigated. The regression equation which is a mathematical description of the response surface is derived. It was found that the cloud of steam influences the depth of concentrated fusion, and the depth is also sensitive to changes in the intensity of the beam current which interacts with the steam.

F.O.S.

N73-20517 National Lending Library for Science and Technology, Boston Spa (England).
FATIGUE PROBLEMS IN WELDED JOINTS
M. Briner 4 Dec. 1972 10 p Transl. into ENGLISH from Chem.-Ing.-Tech. (West Germany), v. 12, no. 44, Jun. 1972 p 801-806
(NLL-Risley-tr-2509-(9091-9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The factors that determine the fatigue behaviour of welded joints are summarized. The question of how the joints can be classified in quality classes or quality grades is discussed. The significance of weld defects where the fatigue strength is concerned is examined. The defects are classified and it is shown how, using fracture mechanics, an attempt is being made to obtain a generalization of test results.

Author

N73-20518 National Lending Library for Science and Technology, Boston Spa (England).
MECHANICS OF THE STRIP DRAWING PROCESS
V. I. Stepanenko, A. G. Stukach, and L. M. Zheleznyak [1972] 11 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), v. 8, 1972 p 93-97 In RUSSIAN and ENGLISH
(NLL-M-21553-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Engineering and energetics methods based on the hypotheses of plane cross sections and deformation zone equilibrium conditions are used to examine the solution to the problem of strip drawing. Formulas are obtained for calculating the drawing stresses and pressures on the draw plate. It is shown that the relationship between these parameters is similar for both approaches, while the drawing stresses are approximately similar. The slightly lower drawing stress given by the engineering approach is due to the fact that no allowance is made for deformation due to shear.

Author

N73-20519*# Callery Chemical Co., Pa.
OPERATING INSTRUCTIONS, DIBORANE SHIPPING CONTAINER DOT SPECIAL PERMIT NO. 6522, VOLUME 3 Final Report
Jun. 1972 153 p
(Contract NASw-1827)
(NASA-CR-131290; CCC-72-3-Vol-3) Avail: NTIS HC $9.75 CSCL 13D

A manual is presented to provide instructions and information for safe and efficient use of the 200-pound diborane shipping container. The scope of the manual includes: shipping, receiving, storage, unloading, return, cleanout, and loading. Backup information on container design and performance, diborane information, etc., are also included.

Author

N73-20520*# Pyronetics, Inc., Santa Fe Springs, Calif.
VALVE, EXPLOSIVE ACTUATED, NORMALLY OPEN, PYRONETICS MODEL 1399 Final Report
Edward Avalos 5 Oct. 1971 57 p refs Prepared for JPL (JPL Order ES-536829)
(NASA-CR-131401; QC/R-6-045) Avail: NTIS HC $5.00 CSCL 13K

Results of the tests to evaluate open valve, Model 1399 are reported for the following tests: proof pressure leakage, actuation, disassembly, and burst pressure. It is concluded that the tests demonstrate the soundness of the structural integrity of the valve. F.O.S.

N73-20521*# PRC Systems Sciences Co., Los Angeles, Calif.
DEVELOPMENT OF KSC PROGRAM FOR INVESTIGATING AND GENERATING FIELD FAILURE RATES. VOLUME 1: SUMMARY AND OVERVIEW Final Report, 24 May 1971 - 24 May 1972
Eloise E. Bean and Charles E. Bloomquist 24 May 1972 36 p refs
(Contract NAS10-7621)
(NASA-CR-131361; PRC-R-1459-Vol-1) Avail: NTIS HC $4.00 CSCL 14D

A summary of the KSC program for investigating the reliability aspects of the ground support activities is presented. An analysis of unsatisfactory condition reports (RC), and the generation of reliability assessment of components based on the URC are discussed along with the design considerations for attaining reliable real time hardware/software configurations. F.O.S.

N73-20522*# General Electric Co., Philadelphia, Pa. Space Div.
ELECTROMAGNETIC FREE SUSPENSION SYSTEM FOR SPACE MANUFACTURING. VOLUME 1: TECHNOLOGY DEPARTMENT Final Report
E. H. Buerger, R. T. Frost, R. H. Lambert, M. F. OConnor, E. L. G. ODell, L. J. Napaluch, E. H. Stockhoff, and G. Wouch 22 Dec. 1972 158 p refs
(Contract NAS8-27228)
(NASA-CR-124134) Avail: NTIS HC $10.00 CSCL 13H

The technology developed in defining a facility to be used on the Skylab mission for electromagnetic suspension of small, molten spheres in the weightless space environment is described. The technologies discussed include: four-coil optimization, four-coil versus six-coil configuration comparison, four-coil position servocontrol, four-coil breadboard, position sensing and servo-system, two-color pyrometer, and specimen toration mode analysis. F.O.S.

N73-20523*# Bertea Corp., Irvine, Calif.
EVALUATION OF A HIGH RESPONSE ELECTROHYDRAULIC DIGITAL CONTROL VALVE Final Progress Report, 29 Feb. 1972 - 28 Feb. 1973
R. L. Anderson 28 Feb. 1973 112 p
(Contract NAS8-28379)
(NASA-CR-124178; Rept-224200-7) Avail: NTIS CSCL 13K

The application is described of a digital control valve on an electrohydraulic servo actuator. The digital control problem is discussed in general as well as the design and evaluation of a breadboard actuator. The evaluation revealed a number of problems associated with matching the valve to a hydraulic load. The problems were related to lost motion resulting from bulk modulus and leakage. These problems were effectively minimized in the breadboard actuator by maintaining a 1000 psi back pressure on the valve circuit and thereby improving the effective bulk modulus. Author

N73-20524*# Hydraulic Research and Mfg. Co., Valencia, Calif.
MODIFICATION, STATIC TESTING AND DELIVERY OF ONE SERVOACTUATOR Final Report
Kenneth E. Hart 6 Jun. 1972 122 p
(Contract NAS8-27928)
(NASA-CR-124025; HR-73700067) Avail: NTIS HC $8.25 CSCL 13I

The development and performance testing of a servoactuator device are discussed. The detailed information includes the following: (1) modification description, (2) test data to include analyses, test procedures, and test data, (3) conclusions, and (4) recommendations. Diagrams of the servoactuator and photographs of the test equipment are presented. Descriptions of optimized system configurations are developed. Author

N73-20525*# McDonnell-Douglas Corp., St. Louis, Mo.
THRUST ISOLATING MOUNTING Patent Application
Dallas G. Wetzler, inventor (to NASA) Filed 21 Mar. 1973 31 p Sponsored by NASA
(NASA-Case-MFS-21680-1; NASA-Case-MFS-21681-1; US-Patent-Appl-SN-343607) Avail: NTIS HC $3.75 CSCL 13I

A supporting frame for a load, such as one or more telescopes, is isolated from all multi-gravitational forces, which will be developed within that load as that load is propelled into space, by using a shroud to fully and solidly hold that load until that load has been propelled into space. Thereafter, that shroud will be jettisoned; and then supports which are on, and which are movable with, that load will have surfaces thereon moved into supporting engagement with complementary surfaces on that supporting frame to enable that supporting frame and those supports to fully and solidly hold that load. NASA

N73-20526*# Conductron Corp., Ann Arbor, Mich.
METHOD OF FABRICATING AN OBJECT WITH A THIN WALL HAVING A PRECISELY SHAPED SLIT Patent Application
P. A. Christopher, W. J. Gross, W. H. Henley, and B. D. Swirsky, inventors (to NASA) Filed 13 Mar. 1973 10 p Sponsored by NASA
(NASA-Case-LAR-10409-1; US-Patent-Appl-SN-340864) Avail: NTIS HC $3.00 CSCL 13H

A method of fabricating an element having a cavity closed by a thin wall with a precisely shaped slit is described. A fixture is used to accurately position an element having a cavity to be closed by the thin wall. After installation of a shim in the fixture and location of the element, the cavity is cast with low melting temperature metal alloy. After solidification of the cast metal, the fixture is removed and the element is electroplated with a thick layer of nickel. The nickel is then machined to .001 inch of the cavity. The metal alloy is then melted, the shims are removed by chemical etching, and the part is finished. NASA

N73-20527*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FRICTION-INDUCED SURFACE ACTIVITY OF SOME HYDROCARBONS WITH CLEAN AND OXIDE-COVERED IRON
Donald H. Buckley Washington Mar. 1973 20 p refs
(NASA-TN-D-7233; E-7273) Avail: NTIS HC $3.00 CSCL 07D

Sliding friction studies were conducted on a clean and oxide-covered iron surface with exposure of that surface to various hydrocarbons. The hydrocarbons included ethane, ethylene ethyl chloride, methyl chloride, and vinyl chloride. Auger cylindrical mirror analysis was used to follow interactions of the hydrocarbon with the iron surface. Results with vinyl chloride indicate friction induced surface reactivity, adsorption to surface oxides, friction sensitivity to concentration and polymerization. Variation in the loads employed influence adsorption and accordingly friction. In contrast with ethyl and vinyl chloride, friction induced surface reactivity was not observed with ethane and ethylene. Author

N73-20528*# National Aeronautics and Space Administration, Washington, D.C.
TESTING METHODS AND TECHNIQUES: QUALITY CONTROL AND NONDESTRUCTIVE TESTING: A COMPLICATION Technology Utilization
[1972] 24 p refs
(NASA-SP-5952(02)) Avail: NTIS HC $1.00 CSCL 14D

A variety of devices and techniques useful in nondestructive testing is described. Ranging in complexity from an automated ultrasonic testing system designed for complex laminated honeycomb structures, to a flexible leak detector probe, the items represent either potential savings in cost and time, or improvement in inspection quality over past techniques. Data cover weld and braze inspection, leak detection, and inspection of composite materials. Author

N73-20529*# Borg-Warner Corp., Bedford, Ohio.
DESIGN, MANUFACTURE, AND TEST OF COOLANT PUMP-MOTOR ASSEMBLY FOR BRAYTON POWER CONVERSION SYSTEM
Louis E. Gabacz Washington NASA Mar. 1973 200 p refs
(Contract NAS23-10935)
(NASA-CR-2176) Avail: NTIS HC $3.00 CSCL 13K

The design, development, fabrication, and testing of seven coolant circulating pump-motor assemblies are discussed. The pump-motor assembly is driven by the nominal 44.4-volt, 400-Hz, 3-phase output of a nominal 56-volt dc input inverter. The pump-motor assembly will be used to circulate Dow Corning 200 liquid coolant for use in a Brayton cycle space power system. The pump-motor assembly develops a nominal head of 70 psi at 3.7 gpm with an over-all efficiency of 26 percent. The design description, drawings, photographs, reliability results, and developmental and acceptance test results are included. Author

N73-20530*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADHESION, FRICTION, AND WEAR OF A COPPER BICRYSTAL WITH (111) AND (210) GRAINS
William A. Brainard and Donald H. Buckley Washington Mar. 1973 19 p refs
(NASA-TN-D-7232; E-7310) Avail: NTIS HC $3.00 CSCL 11H

Sliding friction experiments were conducted in air with polycrystalline copper and ruby riders sliding against a copper bicrystal. Friction coefficient was measured across the bicrystal surface, and the initiation of adhesive wear was examined with scanning electron microscopy. Results indicate a marked increase in friction coefficient as the copper rider crossed the grain boundary from the (111) plane to the (210) plane of the bicrystal. Adhesion, friction, and initiation of adhesive wear was notably different in the adjacent grains of differing orientation. A slip-band adhesion-generated fracture mechanism for wear particle formation is proposed. Author

N73-20531*# AiResearch Mfg. Co., Phoenix, Ariz.
BACKSWEPT IMPELLER AND VANE ISLAND DIFFUSER AND SHROUD FOR NASA ADVANCED-CONCEPTS COMPRESSOR TEST RIG Final Report, 1 May 1970 - 30 Nov. 1972
G. L. Perrone, M. R. Holbrook, and J. M. McVaugh Mar. 1973 47 p
(Contract NAS3-15328)
(NASA-CR-120942; AT-6131-R) Avail: NTIS HC $4.50 CSCL 13I

A centrifugal impeller based on an existing backswept design was defined. In addition, a vaned diffuser was designed to match this impeller and also to be compatible with an existing 6:1 compressor test rig. The mechanical integrity of this design was verified by analysis. Hardware was procured and inspected to insure conformity with design tolerances. An overspeed test was successfully conducted on one of the impellers fabricated under this program. Author

N73-20532*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BOUNDARY LUBRICATION OF FORMULATED C-ETHERS IN AIR TO 300 C. 2: ORGANIC ACID ADDITIVES
William R. Jones, Jr. Washington Apr. 1973 17 p refs
(NASA-TN-D-7254; E-7149) Avail: NTIS HC $3.00 CSCL 11H

Friction and wear measurements were made on CVM M-50 steel lubricated with three C-ether (modified polyphenyl ether) formulations in dry and moist air. Results were compared to those obtained with a formulated Type 2 ester and the C-ether base fluid. A ball-on-disk sliding friction apparatus was used. Experimental conditions were a 1-kilogram load, a 17-meter/minute surface speed, and a 25 to 300 C (77 to 572 F) disk temperature range. The three C-ether formulations yielded better boundary lubricating characteristics than the Type 2 ester under most test conditions. All C-ether formulations exhibited higher friction coefficients than the ester from 150 to 300 C (302 to 572 F) and similar or lower values from 25 to 150 C (77 to 302 F). Author

N73-20533*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
JOURNAL BEARINGS Patent Application
Frederick T. Schuller and Warren A. Moore, inventors (to NASA) Filed 30 Mar. 1973 14 p
(NASA-Case-LEW-11076-2; US-Patent-Appl-SN-346483) Avail: NTIS HC $3.00 CSCL 13I

A description is given of a plurality of bearing sectors for controlling the self-excited instability of zero or lightly loaded shafts when they rotate, at high speeds, in bearings with low viscosity lubricants. The sectors are designed for use in the power generating system of spacecraft employing liquid metals as the working fluid. E.H.W.

N73-20534*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HOLLOW ROLLING ELEMENT BEARINGS Patent Application
Richard J. Parker, inventor (to NASA) Filed 30 Mar. 1973 8 p
(NASA-Case-LEW-11087-3; US-Patent-Appl-SN-346341) Avail: NTIS HC $3.00 CSCL 13I

A low mass rolling element with a lightweight core and a hollow center is described. The core is plated to provide a hard surface. NASA

N73-20535*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
[ELECTRICAL RESISTANCE SPOT WELDING AND BRAZING TECHNIQUES FOR METAL BONDING] Patent Application
Thomas T. Bales, Ashby G. Lawson, and Winfrey E. Arnold, Jr., inventors (to NASA) Filed 11 Aug. 1972 11 p
(NASA-Case-LAR-11072-1; US-Patent-Appl-SN-280030) Avail: NTIS HC $3.00 CSCL 13H

An improved method of bonding metals utilizing the techniques of electric resistance spot-welding and brazing is presented. The spot-welding parameters of pressure, temperature, and time are controlled such that the spot-weld nuggets form a gap of desired dimension between the two metals. The gap is then brazed such that a hermetically sealed braze joint is formed along the gap. The resulting product has mechanical and structural properties superior to those formed by conventional bonding methods. In addition, the hermetically sealed joint prevents environmental corrosion of the spot-weld nuggets. Also, the controlled spot-welding techniques quickly and inexpensively secure and position the two metals with respect to each other, thereby eliminating the expensive and time consuming alinement preparations formerly required for precise brazing. NASA

N73-20536*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
DETECTION OF LACK OF FUSION USING OPAQUE ADDITIVES, PHASE 1
J. L. Cook Nov. 1972 63 p refs
(Contract NAS8-28708)
(NASA-CR-124167; MDC-G4298) Avail: NTIS HC $5.25 CSCL 13H

Two major problems in welded aluminum spacecraft structure, reliable nondestructive inspection for incomplete weldment penetration and the rapid oxidation of aluminum surfaces left exposed to the atmosphere are investigated. The approach employed to solve both problems was to employ copper as a coating to prevent oxidation of the aluminum and as an opaque additive in the weldment to enhance X-ray detection in the event of incomplete penetration. Both plasma spray and vacuum vapor deposition techniques were evaluated for depositing the copper. A series of welded panels was made using three thicknesses of vacuum-vapor-deposited copper. All weldments were nondestructively inspected by X-ray, then excised into tensile and bend specimens. Mechanical tests were conducted and all data evaluated. It was determined that the vacuum-vapor-deposited coating was superior to a plasma sprayed coating of the same thickness. The vacuum-vapor-deposited coating was more uniform in thickness, provided complete coverage of the aluminum, and was free of cracks and porosity. Author

N73-20537*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH TEMPERATURE SOLID LUBRICANTS: WHEN AND

WHERE TO USE THEM
Harold E. Sliney Apr. 1973 25 p refs Presented at the Design Eng. Conf., Philadelphia, 9-12 Apr. 1973: sponsored by ASME
(NASA-TM-X-68201; E-7368) Avail: NTIS HC $3.25 CSCL 11H

The state of the art of solid lubrication for moderate to extremely high temperature lubrication (to 1600 F) is reviewed. Lubricating characteristics, stability in various environments, and relevant machine design considerations are discussed. Lubricating materials discussed include the layer lattice compounds: MoS2, WS2, graphite and graphite fluoride, the high temperature polyimide polymer, and calcium fluoride based coating and composites. The scope of the information includes results from wear testers, ball bearing, and journal bearings. Author

N73-20538*# Arizona Univ., Tucson.
MODERN METHODOLOGY OF DESIGNING TARGET RELIABILITY INTO ROTATING MECHANICAL COMPONENTS
Dimitri B. Kececioglu and Louie B. Chester 31 Jan. 1972 197 p refs
(Grant NGR-03-022-044)
(NASA-CR-120967) Avail: NTIS HC $12.00 CSCL 14D

Experimentally determined distributional cycles-to-failure versus maximum alternating nominal strength (S-N) diagrams, and distributional mean nominal strength versus maximum alternating nominal strength (Goodman) diagrams are presented. These distributional S-N and Goodman diagrams are for AISI 4340 steel, round, cylindrical specimens 0.735 in. in diameter and 6 in. long with a circumferential groove 0.145 in. radius. The specimens are subjected to reversed bending and steady torque in specially built, three complex-fatigue research machines. Based on these results, the effects on the distributional S-N and Goodman diagrams and on service life of superimposing steady torque on reversed bending are established, as well as the effect of various stress concentrations. In addition, a computer program for determining the three-parameter Weibull distribution representing the cycles-to-failure data, and two methods for calculating the reliability of components subjected to cumulative fatigue loads are given. Author

N73-20539# Army Weapons Command, Rock Island, Ill. Weapons Lab.
HIGH-SPEED OSCILLATING TESTS OF LUBRICATING COMPOSITES
Peter Martin, Jr. and George P. Murphy Nov. 1972 23 p refs
(DA Proj. 1W5-62604-A-621)
(AD-755112; SWERR-TR-72-77) Avail: NTIS CSCL 11/8

Twenty-five self-lubricating composites, both plastic and metal-based, were compared on the LFW-1 tester in the oscillatory mode of a 75-degree arc and 200 cycles per minute by use of test loads of 30, 60, and 120 pounds. A metal-based composite composed of molybdenum, molybdenum disulphide, niobium, and copper gave the best friction and wear results of any of the composites tested against either steel or hard-anodized aluminum. For the plastic-based composites, epoxy resin plus graphite fibers of polyamide resin plus graphite gave the best results when tested against steel, whereas polyimide resin plus PTFE gave the best results when tested against hard-anodized aluminum. Author (GRA)

N73-20540# Battelle Columbus Labs., Ohio.
SLEEVE BEARING MATERIALS AND LUBRICANTS FOR ADVANCED AIRFRAMES
Keith F. Dufrane, Fred F. Zugaro, and William A. Glaeser 29 Jan. 1973 42 p refs
(Contract N00019-72-C-0178)
(AD-754759) Avail: NTIS CSCL 01/3

Hardened 440C stainless steel shafts were found to have excellent compatibility with beryllium-copper bearings at high bearing stress levels. Therefore, this steel holds considerable promise for use as a high-performance, corrosion-resistant shaft material. Hardened 300-M shafts were subject to fatigue cracking at bearing stresses above 40,000 psi (the fatigue cracking was similar to that experienced with AISI 4340). Shot peening prior to plating and baking after plating was found to increase the fatigue resistance sufficiently to permit operation at 60,000 psi. Three greases meeting the MIL-G-81322 specification performed well at temperatures to 350 F, and additions of either AsSbS4 or MoS2 were found to enhance the grease performance even further. Author (GRA)

N73-20541# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECTIVENESS OF USING VARIOUS LUBRICANT COOLING FLUIDS FOR DIAMOND SUPERFINISHING
A. I. Timchuk and P. V. Timofeev Oct. 1972 9 p Transl. into ENGLISH from Tekhnol. Organ. Proizvod. (USSR), no. 1, 1971 p 42-43
(AF Proj. 7343)
(AD-753980; FTD-HT-23-977-72) Avail: NTIS CSCL 11/8

Results are presented from studies of the effectiveness of applying various lubricating and cooling fluids for diamond superfinishing at the Khar-kov Serp i Molot plant. Author (GRA)

N73-20542# Mechanical Technology, Inc., Latham, N.Y.
ON THE COMPUTATION OF EDGE CORRECTION FOR THE LOCALLY-INCOMPRESSIBLE NARROW-GROOVE THEORY
Coda H. T. Pan, Pradeep Gupta, and Richard L. Coleman Nov. 1972 44 p refs
(Contract N00014-72-C-0083; NR Proj. 062-317)
(AD-754800; MTI-72TR57) Avail: NTIS CSCL 13/9

The locally-incompressible, narrow-groove theory is deficient in that it fails to satisfy the exact boundary condition of the ambient edge, giving rise to a corresponding inaccuracy in predicted bearing performance which could become significant if the width-to-length ratio of each groove-ridge pair is not sufficiently small. A computation of edge correction is formulated which makes use of the natural, skew coordinate system; a logarithmic transformation of the longitudinal coordinate mapped its infinite extent onto a finite domain to facilitate numerical computation. Conventional finite difference approximation was then imposed. Author (GRA)

N73-20543# Arizona Univ., Tucson. Optical Sciences Center.
INVESTIGATION OF TECHNIQUES FOR FABRICATING PLASTIC OPTICAL COMPONENTS
Stephen Blecher Aug. 1972 54 p refs
(Contract N00039-69-C-0554)
(AD-754818; OSC-TR-77) Avail: NTIS CSCL 11/9

Because of their light weight and low cost, transparent plastics would seem to be good materials for optical components. The report deals primarily with the feasibility of producing large (=4-in.-diam) plastic components of moderate precision (surface accuracies of about 1 fringe per inch of diameter). The structure and the physical and optical properties of plastics are discussed, with emphasis on their advantages and limitations for optical use. A series of experiments on grinding and polishing of plastics was conducted. Data are presented on grinding rates. Several polishing processes were evaluated, and a polishing technique for plastics was developed. Polishing rate data and surface roughness data are presented for several polishing processes. A series of experiments was conducted on a process called compression forming, in which heat and pressure are applied to machined preforms in an attempt to obtain precision optical surfaces. The process is described in detail, and experimental results are discussed. GRA

N73-20544# Wisconsin Univ., Madison. Mathematics Research Center.
THE HERTZ CONTACT PROBLEM WITH FINITE FRICTION
D. A. Spence Oct. 1972 53 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-755071; MRC-TSR-1209) Avail: NTIS CSCL 20/11

The indentation of an elastic half space by a rigid axisymmetric punch under a monotonically applied normal force is formulated as a mixed boundary value problem under the assumption of Coulomb friction in the region of contact. It is shown that within an inner circle the contact is adhesive, and that in the surrounding annulus the surface moves inwards with increasing load. The slip boundary between the two regions is an eigenvalue depending on the friction coefficient mu and the Poisson ratio ni of the half space. An iterative numerical solution for flat-faced indentors

in terms of a dual system of Volterra equations is described.
Author (GRA)

N73-20545# Army Weapons Command, Rock Island, Ill. Weapons Lab.
SOLID LUBRICANT COATINGS CURABLE AT 225 F - 300 F
George Murphy, Jr. Jul. 1972 22 p refs
(DA Proj. 1G0-62105-A-107)
(AD-754568; SWERR-TR-72-48) Avail: NTIS CSCL 11/8

Experimental solid-film lubricant coatings based on urea-formaldehyde, epoxy-polyamide, epoxy-silane, alkyd-urea, melamine-acrylic, and epoxy-urea resins were formulated for use on the M16-A1 rifle. These coatings are cured after being applied to the rifle, and thus low temperatures are needed so as not to adversely affect the rifle's strength. None of these coatings when cured at temperatures of 225-300F had antiwear or corrosion preventing properties comparable to the fully cured MIL-L-46010A type of solid lubricant coating now used. Of the experimental formulations tested, those based on the urea-formaldehyde and epoxy-silane resins gave the best results. However, with the addition of a curing agent, boron trifluoride monoethylamine complex, to a qualified MIL-L-46010A base, the product could be cured at 275F, and all test requirements could be satisfied. Author (GRA)

N73-20546# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF THE OVALITY OF THE BALLS OF A RADIAL-THRUST BEARING ON THE AXIAL VIBRATION OF A RAPIDLY ROTATING ROTOR OF AN ENGINE
I. A. Baranov and A. I. Ilyankov 3 Jan. 1973 20 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekhn. (Kazan), v. 14, no. 2, 1971 p 39-45
(AF Proj. 3048)
(AD-754615; FTD-MT-24-1299-72) Avail: NTIS CSCL 13/9

It is shown that ovality of radial thrust bearing balls generate vibrations in an engine with a rapidly rotating turbine, and that the vibration spectrum contains harmonic components which are multiples of the double frequency of revolution of the balls. Formulas for calculating the amplitudes of these components are proposed. Author (GRA)

N73-20547# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD FOR PRODUCING HIGH-PRESSURE TANKS AND RODS MADE FROM UNIDIRECTIONAL GLASS-FIBER-REINFORCED PLASTIC
V. S. Gumenyuk 9 Mar. 1973 21 p refs Transl. into ENGLISH from the publ. "Armirovannyye Materialy i Konstruksii Iz Nikh" USSR, 1970 p 227-241
(AD-754679; FTD-HT-23-1606-72) Avail: NTIS CSCL 13/4

The procedure is described for selection of the optimal shape, the production technology, and the results of experimental research on the carrying capacity of high pressure fiberglass reinforced plastic containers. A lenticular shape of the container was acknowledged to be the optimal one. The design of this container includes a fiber glass reinforced plastic force shell of variable thickness, made by the wet winding method, a sealing shell of crude rubber or duraluminum alloy and two metal pieces with reinforcements. Also described are the reinforcement system, the production technology, and the results of experimental research on the stability of fiber glass reinforced plastic rods.
Author (GRA)

N73-20548# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INFLUENCE OF ZINC DIAMYLDITHIOCARBAMATE ON THE STABILITY OF MINERAL OIL INHIBITED WITH 2.6 DITERCIARYBUTYL-P-CRESOL
S. Arsic 20 Nov. 1972 15 p refs Transl. into ENGLISH from Tehnika Podmazivanja Primena Goriva (Yugoslavia), v. 9, no. 4, 1970 p 25-33
(AF Proj. 7343)
(AD-754664; FTD-HC-23-612-72) Avail: NTIS CSCL 11/8

On the basis of theoretical considerations about the difference in mechanism of 2.6-di-tert-butyl-p-cresol (DBPK) and zinc diamyldithiocarbamate (ZDATK) activities, the author investigates experimentally the mutual interaction of these oxidation inhibitors when used in various ratios within a stable mineral oil. Experiments show that they are compatible and that they exhibit, for certain concentrations, even a synergetic effect. He concludes that the combination of certain definite concentrations of these inhibitors may be used during the production of oil of turbine or hydraulic quality. Author (GRA)

N73-20549# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF AN OIL BASE ON THE LUBRICATING ABILITY OF PLASTIC LUBRICANTS
V. V. Vainshtok, R. A. Levento, L. Gelchinskaya, and N. S. Smirnova 13 Dec. 1972 15 p refs Transl. into ENGLISH from Neftepererab. Neftekhim. (Moscow), no. 7, 1971 p 17-20
(AF Proj. 7343)
(AD-754593; FTD-HT-23-1216-72) Avail: NTIS CSCL 11/8

The hydrocarbon greases, except those prepared from isoparaffinic oils, had lubricities similar to those of the base oil. Li greases with hydrocarbon oil base differed considerably from the base. Li soaps and surfactants reduced wear more than the nonpolar solid hydrocarbons. A qualitative correspondence was detected between the antiwear properties of the oils and greases prepared with these oils. Author (GRA)

N73-20550# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INCREASING THE QUALITY OF BEARING-UNIT ASSEMBLY BY THE USE OF PLASTIC COMPENSATORS
B. F. Fedorov, N. V. Semenov, and I. K. Pichugin 26 Dec. 1972 12 p refs Transl. into ENGLISH from Povysh. Kach., Nadezhnosti i Dolgovechnosti Mashin i Izdelii (USSR), no. 64, 1970 p 165-169
(AF Proj. 7343)
(AD-754591; FTD-HT-23-775-72) Avail: NTIS CSCL 13/9

The following method of assembling bearing parts is presented: initially openings for the bearings are bored 4 to 6 mm greater than the external diameter of the bearing and degreased; the external diameter of the bearing is coated with a dividing film and rollers are placed in the casing with the bearings fixed on them and they are checked for the necessary accuracy, the gaps of the seat of the bearing are filled with cold hardening acrylic plastic AST-T (STU 79-1648-64) in a state of a homogeneous following mass. Author (GRA)

N73-20551# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF DEFECTS IN THE GEOMETRIC SHAPE OF ANTIFRICTION BEARINGS ON THE BALANCING PRECISION OF RIGID ROTORS
I. I. Rybin 24 Nov. 1972 16 p refs Transl. into ENGLISH from the book "Teoriya i Prakt. Uravnoveshivaniya Mashin i Priborov" Moscow, 1970 p 371-377
(AF Proj. 3048)
(AD-754610; FTD-MT-24-998-72) Avail: NTIS CSCL 13/9

The article deals with the influence of errors of the geometrical shape of rolling bearings upon the balancing precision for a special case, namely in application to balancing machines with two movable supports, and of the frame type, with account taken of gaps in the bearings. The influence of the errors was determined on the basis of trigonometric series which express their relationship to a series of parameters of the entire system. From the derived equation is determined the permissible value of the total ovality of the inner races of the rolling bearings of the balanced rotor, which practically does not affect the balancing precision. Author (GRA)

N73-20552# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF SOLDERING PROCESS OF GRAPHITE MATERIALS WITH FORMATION OF A CARBIDE INTERLAYER
L. T. Anikin and G. A. Kravetskii 11 Dec. 1972 15 p refs Transl. into ENGLISH from the book "Tugoplavkie Karbidy" Kiev, Naukova Dumka, 1970 p 82-87
(AD-754050; FTD-MT-24-1492-72) Avail: NTIS CSCL 13/8

The formation of a zirconium carbide with a composition close to stoichiometric and, consequently, a maximal heat resistance for a soldered joint is observed at a soldering

temperature of 2500C and a holding time of no less than 4 min. Similar results are obtained when the soldering temperature is reduced to 2000C while the holding time at this temperature is no less than 2 hr. The optimal soldering regime for molybdenum is a soldering temperature of more than 2200C and a holding time of no less than 3 min. For soldering under optimal conditions with specimens heated to 2000C the strength of the weld is, as a rule, as great as that of the base material. Author (GRA)

N73-20553# IIT Research Inst., Chicago, Ill.
CONTRIBUTIONS TO A THEORY OF WIRABILITY Final Report, 15 Feb. 1970 - 15 Aug. 1972
Scott H. Cameron 1 Jan. 1973 94 p
(Contract N00014-70-C-0245; IITRI Proj. E6170)
(AD-754451; IITRI-E6170-FR) Avail: NTIS CSCL 09/5

The report concerns the generation of printed circuit wiring patterns by efficient automatic procedures. The major topics treated in the report include the following: An algebraic formulation of the planar wiring problem based on a hexagonal, i.e., triply connected, host network in which the existence of a solution to particular wiring problems depends on the consistency of a set of simultaneous Boolean equations; A graph theoretic formulation which solves the problem for two competing interconnection nets by the generation of a tree of non-separating paths in the host network; and A planarity testing procedure which generates a planar drawing of a particular type of graph, a so-called permutation graph, in all cases where the graph is planar. GRA

N73-20554# General American Transportation Corp., Niles, Ill. Research Div.
APPLICATION OF CYCLOIDAL CAM TYPE SPEED REDUCERS TO MARINE GAS TURBINE ENGINES Final Report, Mar. - Jun. 1972
Veljko Milenkovic and Thomas H. Sytko Jun. 1972 94 p refs
(Contract N00014-72-C-0178; NR Proj. 249-035; SF3543231)
(AD-754822) Avail: NTIS CSCL 13/9

The report covers the results obtained during the period March 1972 to June 1972 on a study program of cycloidal cam type transmissions. The objective was to provide design criteria for determining the maximum horsepower that can be transmitted using a cycloidal cam transmission for reduction ratios from 10:1 to 100:1 and input speeds from 500 to 12,500 rpm with a service life of 30,000 hours. From the analysis uncovered in the literature and that developed by AGARD personnel a computer program was developed to optimize the cycloidal cam type transmission and analyze the stresses on the load carrying members. Contact stresses at the input crank shaft, reaction rollers and reverter pins were computed. Design limitations were assumed to be a rolling element contact fatigue stress limit of 200,000 psi, a roller bearing DN value of 1,300,000 and a maximum crankshaft shear stress of 50,000 spi. All transmission elements were assumed to be steel. Author (GRA)

N73-20555# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE RELATIONSHIP BETWEEN ADHESION AND FRICTION IN CUTTING WITHOUT BUILD-UP
M. B. Gordon 13 Dec. 1972 13 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostr. (USSR), no. 3, 1971 p 156-159
(AF Proj. 7351)
(AD-754041; FTD-HT-23-1210-72) Avail: NTIS CSCL 13/8

The adhesion forces in cutting metals are the basic cause of high friction coefficients and of departure from the classical laws of friction. The formation and destruction of adhesive connections induces the wear of the cutting tool. The adhesion is one of the basic sources of the formation of the roughness of treated surfaces. Information about the tangential force of adhesion and the actual contact area on the front surface of the cutter is provided. It is determined that the adhesive force monotonically decreases in proportion to the withdrawal of the contact area from the cutting edge. Author (GRA)

N73-20556# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
George Allen Beale Jan. 1973 31 p
(AF Proj. 3148)
(AD-754963; AFRPL-TR-72-130) Avail: NTIS CSCL 13/7

A program was initiated to change the gas source used for operation of a standard 12 inch fast gate valve from a high pressure bottled gas feed system to a pyrotechnic gas generator feed system. To accomplish this change, Lockheed Missiles and Space Company designed and developed the gas generator. Lawrence Research Laboratory provided the valve design changes required, and the Air Force Rocket Propulsion Laboratory made the modifications to the valve and provided the test facilities and personnel to test and evaluate the new mode of operation. Author (GRA)

N73-20557# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF THE TECHNOLOGICAL POSSIBILITIES FOR PULSED ELECTRON BEAM WELDING OF SHEET MATERIALS
A. F. Khudyshev and G. A. Slavin 3 Nov. 1972 17 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (USSR), no. 3, 1971 p 13-19
(AD-754684; FTD-MT-24-1490-72) Avail: NTIS CSCL 13/8

The article presents the research data on the technological and thermal characteristics of the pulsed electron-beam. Shown is the effect of the electron-beam parameters on its penetrative ability and forming of the welds. It is shown that the pulsed introduction of heat broadens the technological possibilities of the electron-beam welding process considerably. Author (GRA)

N73-20558# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
EVALUATION AND ANALYSIS OF THE 6950 ELECTRON TUBE PACK
Joseph D. Loper Jan. 1973 33 p
(AF Proj. 71-27-C-4)
(AD-754926; DSPT-45) Avail: NTIS CSCL 13/4

The objective of the study was to evaluate the shock and vibration protection provided by the shipping container and spring suspension cushion system used in packaging the type 6950 electron tube. If it were found that the container system provided insufficient protection for the tube, the study would be directed toward the development of a new or modified pack. A deficiency in the form of a highly resonant condition was detected during vibration testing at 4.0 Hz. Therefore, several methods of attenuating the vibration were developed and evaluated. The results of the evaluation indicated that the use of polyurethane detuning snubbers was the most effective and efficient method of reducing the resonant condition. Author (GRA)

N73-20559# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMAL PHENOMENA AND SURFACE-LAYER QUALITY DURING POLISHING OF PARTS OF TWO ROW ROLLER BEARINGS WITH AN ABRASIVE CLOTH
S. P. Shabashov and E. I. Studenskii 26 Dec. 1972 10 p Transl. into ENGLISH of the Publ. "Teplofizika Tekhnologicheskik Protsessov" Kuybyshev, 1970 p 119-121
(AF Proj. 7343)
(AD-754678; FTD-HT-23-1554-72) Avail: NTIS CSCL 13/8

The purpose of the study was to establish the limiting permissible value of temperature in the polishing zone and to find the relationship between the temperature and the surface layer quality, and also to determine the dependence between temperature and polishing mode elements. Author (GRA)

N73-20560# Picatinny Arsenal, Dover, N.J.
USE OF MULTIPLE REGRESSION ANALYSIS TO DEVELOP PREDICTIVE MODELS FOR FAILURE TIMES OF ADHESIVE BONDS AT CONSTANT STRESS. PART 1: TITANIUM ADHERENDS
William C. Jones, III, Elise McAbee, Raymond F. Wegman, and David W. Levi Dec. 1972 35 p refs
(AD-754526; PA-TR-4386) Avail: NTIS CSCL 13/5

Predictive equations were developed for failure times of

relative humidity, stress, and (initially) surface pretreatment. The predictive equations were developed using multiple regression analysis which was performed by computer. Many models with both theoretical and empirical bases were considered. Statistical methods were used to find the best model based on correlation coefficients and significance of variables. Author (GRA)

N73-20561# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE EMULSIFYING CAPACITY OF OILS AND WEARABILITY OF ADDITIVES DURING CONTACT WITH WATER
I. E. Vinogradov and M. I. Nosov 22 Dec. 1972 19 p refs Transl. into ENGLISH from Tr. Vses. Nauchn.-Issled. Inst. po Pererabotke Nefti (Moscow), no. 12, 1970 p 248-255
(AF Proj. 7343)
(AD-754622; FTD-MT-24-1081-72) Avail: NTIS CSCL 11/8

In this work the effect of demulsifiers on the water contaminability of the oil and their wearability and the effect of film-strength and antiwear additives to oils on emulsifying capacity were studied; furthermore, the change in properties of the lubricating compositions after their contact with water was investigated. GRA

N73-20562# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHODOLOGY FOR FINDING THE OPTIMAL CONDITIONS FOR LUBRICATION AND COOLING DURING GRINDING BY ABRASIVE DISCS OF SYNTHETIC SUPERHARD MATERIALS
V. V. Andreev and V. E. Shmatov 9 Jan. 1973 11 p refs Transl. into ENGLISH from Vopr. Tekhnol. Mashinostr. (USSR), v. 26, no. 6, 1970 p 5-7
(AF Proj. 7343)
(AD-754665; FTD-HT-23-872-72) Avail: NTIS CSCL 13/8

The following are proposed as basic technical criteria for selecting effective lubricating cooling liquids and rational modes for polishing: (a) rate of processing (g/min, cu mm/min); (b) specific yield of circles of synthetic ultrahard materials (mg.g, mg/cu cm); (c) the quality of the treated surface (roughness presence of a defect layer). Author (GRA)

N73-20563# Naval Postgraduate School, Monterey, Calif.
AN EVALUATION OF THE TRW METHOD OF COMBINING POINT ESTIMATES OF RELIABILITY M.S. Thesis
Robert Emmett Sheridan Sep. 1972 34 p refs
(AD-754347) Avail: NTIS CSCL 14/4

A computer program was written that carries out reliability assessments according to a method proposed by the TRW Corporation. This method combines point estimates for reliability from different sources into an overall point estimate. The program was used to calculate the overall point estimate for cases covering a range of sample sizes, and underlying probabilities of success in order to make a judgement on the usefulness of the method. Author (GRA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N73-20564*# Maryland Univ., College Park. Dept. of Electrical Engineering.
COLD CATHODES FOR SEALED OFF CO2 LASERS Final Report
U. Hochuli Jan. 1973 104 p refs Sponsored in part by ONR and ARPA
(Grants NGR-21-002-216; NGR-21-002-345)
(NASA-CR-130202) Avail: NTIS HC $7.25 CSCL 20E

Experimental results of a group of theoretically selected cold cathode materials are presented. These tests indicate Ag-CuO, Cu and Pt-Cu as three new cold cathode materials for sealed off CO2 lasers. The power output of a test with an Ag-CuO cathode and a gas volume of only 50 cubic centimeters varied from 0.72 W to 1.1 W at 3000 hours and yields still 0.88 W after 8000 hours. Gas discharge tubes with Cu cathodes and a volume of 25 cubic centimeters yield life times in excess of 10,000 hours. Gas analysis results, obtained from a similar tube over a period of 3000 hours, look most promising. A Pt-Cu alloy cathode shows an extremely promising V-I characteristic over a period of 2800 hours. Author

N73-20565# Defence Research Establishment Valcartier (Quebec).
PARAMETRIC STUDIES OF PULSED HF LASERS USING TRANSVERSE EXCITATION
T. V. Jacobson and G. H. Kimbell Jan. 1973 23 p refs
(Proj. 95-10-68)
(DREV-TN-2047/73) Avail: NTIS HC $3.25

A detailed comparison of four types of electrode structures for HF laser action was made. The HF was produced by transverse discharges through SF6/RH mixtures. The pulse energy, pulse duration, and spectroscopic output were measured as a function of the type of hydrogen donor, its partial pressure, and the total pressure when He was added. The hydrogen donors were H2, HC4, C2H6, C3H8, and commercial gasoline. Author

N73-20566# Defence Research Establishment Valcartier (Quebec).
SINGLE NANOSECOND PULSE GENERATION FROM A MODE LOCKED TEA CO2 LASER
F. Rheault, J. L. LaChambre, J. Gilbert, R. Fortin, and M. Blanchard Dec. 1972 15 p refs
(DREV-TN-2024/72) Avail: NTIS HC $3.00

The isolation of a single pulse from a transversely excited atmospheric (TEA) CO2 laser, actively mode locked by an acoustic loss modulator, is described. The single pulse selection has been achieved with the aid of a gallium arsenide electrooptic shutter located either inside or outside the laser resonator. Pulses of 1 megawatt peak power and 2 nanosecond duration have been recorded with instrument limited precision. The availability of such pulses uncovers new possibilities for the investigation of laser-matter interactions at 10.6 microns. Author

N73-20567# Defence Research Establishment Valcartier (Quebec).
REVIEW OF 10.6 MICROMETER DETECTION TECHNIQUES
A. Lagace Jan. 1973 24 p refs
(DREV-TN-2052/73) Avail: NTIS HC $3.25

Direct detection, heterodyning and up-conversion are briefly reviewed. Direct detection and heterodyning are compared as detection techniques for TEA-CO2 lasers. The performance of photodiodes and photoconductors as detectors and mixers is analyzed. It is shown that for 100 nsec pulses, heterodyning has a 45 db gain over direct detection. Author

N73-20568*# National Aeronautics and Space Administration, Washington, D.C.
LASERS
I. Zagura Mar. 1973 7 p Transl. into ENGLISH from Vestn. Protivovozdushnoy Oborony (USSR), no. 1, 1973 p 81-83
(NASA-TT-F-14871) Avail: NTIS HC $3.00 CSCL 20E

Laser systems of various configurations are described and their technological applications are considered. Outlined are laser systems in radio astronomy, radar, earth and space communications, welding and drilling operations, metal vaporization, automatic control systems, atmospheric soundings, and holography. G.G.

N73-20569*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
OPTICAL MODULATOR SYSTEM Final Report
J. Brand Oct. 1972 93 p
(Contract NAS5-11474)
(NASA-CR-130195) Avail: NTIS HC $6.75 CSCL 20E

The fabrication, test, and delivery of an optical modulator system which will operate with a mode-locked Nd:YAG laser indicating at either 1.06 or 0.53 micrometers is discussed. The delivered hardware operates at data rates up to 400 Mbps and includes a 0.53 micrometer electrooptic modulator, a 1.06 micrometer electrooptic modulator with power supply and signal processing electronics with power supply. The modulators contain solid state drivers which accept digital signals with MECL

logic levels, temperature controllers to maintain a stable thermal environment for the modulator crystals, and automatic electronic compensation to maximize the extinction ratio. The modulators use two lithium tantalate crystals cascaded in a double pass configuration. The signal processing electronics include encoding electronics which are capable of digitizing analog signals between the limit of + or - 0.75 volts at a maximum rate of 80 megasamples per second with 5 bit resolution. The digital samples are serialized and made available as a 400 Mbps serial NRZ data source for the modulators. A pseudorandom (PN) generator is also included in the signal processing electronics. This data source generates PN sequences with lengths between 31 bits and 32,767 bits in a serial NRZ format at rates up to 400 Mbps.

Author

N73-20570# Naval Weapons Center, China Lake, Calif. Physical Optics Branch.

LASER MIRROR TECHNOLOGY Annual Report, Jul. 1971 - Jul. 1972

Nov. 1972 25 p refs Prepared for AFWL

(AFWL Proj. 72-022; ZR00001)

(AD-754101; NWC-TP-5425) Avail: NTIS CSCL 20/5

The effects of microroughness, crystalline imperfections, and thin film deposition conditions on the absorption of infrared radiation by laser mirrors are discussed. New instruments described include the Optical Evaluation Facility for measuring absorption and scattering from samples of arbitrary size and curvature, and a modulated ellipsometer for in situ measurements of optical properties of samples under ultrahigh vacuum conditions and conditions of known residual gas environment. Techniques for characterizing surfaces with microirregularities using optical scattering, optical and electron microscopy, and interferometry are described. Initial results obtained using the modulated ellipsometer are discussed, and data obtained from measurements of infrared absorption on silver surfaces of known roughness are presented. Author (GRA)

N73-20571# Owens-Illinois, Inc., Toledo, Ohio. Consumer and Technical Products Div.

DAMAGE THRESHOLD STUDIES OF GLASS LASER MATERIALS Semiannual Technical Report, 1 Jul. - 31 Dec. 1972

Norman L. Boling and George Dube 31 Jan. 1973 26 p refs

(Contract DAHC15-72-C-0170)

(AD-755134) Avail: NTIS CSCL 20/5

A technique for measuring the beam profile of damaging laser pulses has been incorporated into the damage test facility. This technique utilizes an infrared sensitive television camera, a monitor, and a video tape. With this system, more accurate and consistent measurements of surface damage thresholds should be possible. A series of experiments to determine whether absorption is important in surface damage is in progress. Speculations on the effect of electrostatic changing of surfaces on damage threshold are presented. Estimates indicate that application of electrostatic fields would be useful in determining damage mechanisms in some materials. Author (GRA)

N73-20572# Army Electronics Command, Fort Monmouth, N.J.

PRELIMINARY RESULTS OF AN INVESTIGATION OF TRANSVERSE EXCITED ATMOSPHERIC LASERS

C. J. Bickart and J. N. Fulton Nov. 1972 22 p refs

(DA Proj. 1S6-62703-A-056)

(AD-754544; ECOM-4042) Avail: NTIS CSCL 20/5

The report describes the design of two types of CO2, transverse excited atmospheric (TEA) pulsed lasers and preliminary experimental results achieved. The pin-rod laser is compared with the flat electrode double discharge laser. A program for TEA laser mode and transition control is described. It is concluded that if pulse to pulse frequency stability (a few MHz) can be achieved, the CO2 TEA devices would be valuable in ranging, obstacle avoidance, and other pulsed radar applications. Author (GRA)

N73-20573# Naval Research Lab., Washington, D.C. Laser Physics Branch.

ARPA-NRL LASER PROGRAM Semiannual Technical Report, 1 Jan. - 31 Jul. 1972

J. R. Airey, O. C. Barr, N. Djeu, J. L. Emmett, J. Holzrichter, T. Kan, J. P. Letellier, J. Marzolf, J. M. McMahon, S. Searles et al Nov. 1972 162 p refs

(ARPA Order 2062)

(AD-754410; NRL-MR-2529) Avail: NTIS CSCL 20/5

The ARPA-NRL high energy laser program is concerned with the development of laser technology in four program areas; Chemical Lasers, Electric Discharge Lasers; High Power Glass Lasers and New Laser Techniques. The report summarizes the progress made in those areas during the last half of FY 72. Author (GRA)

N73-20574# Lincoln Lab., Mass. Inst. of Tech., Lexington.

OPTICS RESEARCH, 1972:1 Semiannual Report, 1 Jan. - 30 Jun. 1972

Robert H. Rediker 19 Dec. 1972 106 p refs

(Contract F19628-70-C-0230; ARPA Order 600)

(AD-754939; ESD-TR-72-195) Avail: NTIS CSCL 20/5

The report covers work of the Optics Division at Lincoln Laboratory for the period 1 January through 30 June 1972. The topics covered are laser technology and propagation, optical measurements and instrumentation, and laser radar. Additional information on the optics program may be found in the semiannual technical summary reports to the Advanced Research Projects Agency. Author (GRA)

N73-20575# Cornell Univ., Ithaca, N.Y. Lab. of Plasma Studies.

RESEARCH ON MOLECULAR LASERS Annual Report, 1 Oct. 1971 - 30 Sep. 1972

George J. Wolga, Simon H. Bauer, Ross A. McFarlane, Donald Turcotte, and T. A. Cool 30 Sep. 1972 155 p refs

(Contract N00014-67-A-0077-0006; ARPA Order 660)

(AD-754792) Avail: NTIS CSCL 20/5

The report presents the results of research concerning molecular and chemical lasers. The topics include: Measurement of V to V and V to R,T rates among hydrogen halide molecules and the temperature dependence of the energy transfer rates previously determined for HF, DF, HF/CO2DG/CO2 systems; Studies on rapid subsonic gas mixing with emphasis on turbulence to enhance rapid mixing; Vibrational relaxation studies of CO2 in the pressure range 1-100 atm.; TES HBr chemical laser studies; EPR study of reaction rates in the NO - F2 dissociative reaction; Chemical laser studies of the reaction of atomic oxygen and acetylene including the determination of V to V energy transfer probabilities; Studies of the partition of exothermicity in the CS2-O2 chemical laser system; and Experimental study of the relaxation of CO2(020) and HF(v = 1) by collisions with H and F atoms. Author (GRA)

N73-20576# General Electric Co., Schenectady, N.Y. Corporate Research and Development.

OXIDE CERAMIC LASER Semiannual Technical Report

Charles D. Greskovich 25 Jan. 1973 43 p refs

(Contract N00014-70-C-0360; ARPA Order 1587)

(AD-754837; SRD-73-017) Avail: NTIS CSCL 20/5

Several attempts were made to reduce or eliminate orange peel and extended defect formation in NDY ceramics by introducing changes in powder preparation, processing, and thermal cycling conditions. The preparation of oxalate powder by an aerosol technique reduced residual porosity and orange peel in sintered material made from unmilled powder. A dry milling operation was, nevertheless, the most effective method of reducing orange peel. The lasing performance of NDY laser rods is probably limited by submicroscopic scattering centers having compositional variations in the solid solution matrix. Evidence of substructure in the matrix was revealed by ultramicroscopy and chemical etching techniques. A rapid cooling treatment, again, produced a laser rod with improved lasting performance. It was discovered that controlled oxidation of Yttralox generates a pronounced IR filter behavior. Author (GRA)

N73-20577# Army Foreign Science and Technology Center, Charlottesville, Va.

SIMPLE SCHEME FOR OBTAINING HOLOGRAPHIC INTERFEROGRAMS IN A REAL TIME SCALE

M. M. Butuson 21 Dec. 1972 5 p refs Transl. into ENGLISH from Zh. Nauch. Prikl. Fotogr. Kinematogr. (USSR), v. 16, Jul./Aug. 1971 p 304-4

(AD-754632; FSTC-HT-23-2070-72) Avail: NTIS CSCL 14/5

Holographic interferograms on a real time scale arise during observation of an interference image between the unperturbed image of an object recorded on a hologram, and the object observed through the hologram as it changes. The method turns out to be very convenient for rapid familiarization with the nature of deformations and vibrations of any shape, with the configuration of gas streams and so forth. GRA

N73-20578# Edgerton, Germeshausen and Grier, Inc., Salem, Mass.

OPTICAL PUMPS FOR LASERS Triannual Report, No. 1, 24 Apr. - 23 Aug. 1972

P. Bruce Newell Nov. 1972 45 p refs

(Contract DAAB07-72-C-0165; DA Proj. 1S6-64723-DL-71)

(AD-754643; ECOM-0165-1) Avail: NTIS CSCL 20/5

The report covers the investigation and improvement of those lamp design and operating parameters which affect laser stability and beam divergence; specifically, an improvement in the flashtube arc column spacial uniformity. Approaches being undertaken to achieve a uniform radiating volume are discussed. A theoretical study of the arc compares rates of growth and discusses oscillations that may appear in capillary lamps. Preliminary acoustical analysis has not revealed the presence of a radial oscillation. Experimental data relating to radiance, cross-sectional profiles, and diameters versus pressure in an unconfined geometry are presented. A fluorescence meter has been constructed and will be used to evaluate small-bore lamps of various constructions. The value of diffusing and fluorescing envelopes is discussed, together with the design of specialized driving circuitry. The program for the second tri-annual period is summarized. Author (GRA)

N73-20579# TRW Systems Group, Redondo Beach, Calif.

PORTABLE LASER VELOCIMETER FOR STACK VELOCITY MEASUREMENTS Final Report

L. O. Heflinger, B. J. Matthews, and H. Shelton Nov. 1972 68 p refs

(Contract EPA-68-02-0308)

(PB-213263; TRW-20852-6002-R0-00; EPA-R2-72-132) Avail: NTIS HC $3.00 CSCL 14B

The report describes the design and development of a short range, laser velocimeter together with the analysis of optical velocity measurement techniques over ranges up to 1500 ft. This laser velocimeter operates on an interference-backscatter principle. It is portable and designed to measure velocities of flowing particle laden gases in power plant ducts or stacks at relatively close ranges. The instrument is composed of a sensing head cabinet and an electronics cabinet. The sensing head incorporates a laser illuminator, beam forming optics and photodetector. The electronics cabinet contains a signal processing circuit, spectrum analyzer, and power supplies for the laser and spectrum analyzer. The design, construction and preliminary testing of the velocimeter are discussed. Also presented is an analysis of optical velocity measuring devices for extended range operation. Three types of optical velocimeters were considered: Doppler shift, interference-fringe and a reticle velocimeter. Author (GRA)

N73-20580# Army Materials and Mechanics Research Center, Watertown, Mass.

STATE OF THE ART SURVEY ON HOLOGRAPHY AND MICROWAVES IN NONDESTRUCTIVE TESTING Monograph Series

Robert C. Grubinskas Sep. 1972 114 p refs Presented at 13th Intern. Meeting of the Tech. Cooperation program's working panel 4, sub-group P, Evaluation Methods for Mater. and Mater. in Struct., Anaheim, Calif., 20-29 Apr. 1971

(AD-755116; AMMRC-MS-72-9) Avail: NTIS CSCL 14/2

The object of this monograph is to trace the evolution of relatively new nondestructive testing techniques arising from the vigorously active fields of holography and microwaves. Highlighted areas include the description of existing techniques and a discussion of their capabilities and limitations. Receiving primary emphasis are the applications of these techniques to the evaluation of materials, structures, and end items for quality assurance purposes. An extensive reference and bibliographical section has also been included to increase the usefulness of this document and to provide a launching point for further study. Author (GRA)

N73-20581# Stanford Univ., Calif. Microwave Lab.

RESEARCH STUDIES ON NONLINEAR OPTICAL PROCESSES IN METALLIC VAPORS Annual Report, 1972

A. H. Kung, J. F. Young, G. C. Bjorklund, S. E. Harris, and R. B. Miles Dec. 1972 32 p refs

(Contract N00014-67-A-0112-0036; NR Proj. 016-106)

(AD-754096; ML-2126) Avail: NTIS CSCL 20/5

Described is research work aimed at the development of techniques for frequency tripling laser radiation which is incident on mixtures of metal vapors and inert gases. Principal accomplishments of the program include: the demonstration of the first nonlinear optical technique in the vacuum ultraviolet region of the spectrum; the generation of kW peak powers at 1773 A, 1520 A, and 1182 A; the development of a very general analysis for studying the potential conversion efficiency in the alkali metal-inert gas system; and most recently the proposal and demonstration of the very simple technique of third harmonic generation in mixtures of inert gases. Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N73-20582 National Lending Library for Science and Technology, Boston Spa (England).

SHORT-TIME ELEVATED TEMPERATURE PROPERTIES OF PLATINUM METALS. 3: PLATINUM, RHODIUM, PALLADIUM ALLOYS

G. Reinacher [1972] 9 p Transl. into ENGLISH from Metall (East Berlin), v. 16, July 1962 p 662-668

(NLL-M-22799-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The short time elevated temperature properties of platinum, rhodium, and palladium alloys are discussed. The test equipment used in the tests and the temperature regimes are described. The properties investigated are: (1) elevated temperature tensile properties, (2) creep properties, (3) creep elongation and reduction of area, and (4) type of fracture found in creep specimens. Author

N73-20583 National Lending Library for Science and Technology, Boston Spa (England).

THE STRUCTURE OF ZINC-COPPER-TITANIUM ALLOYS

E. Pelzel [1972] 10 p refs Transl. into ENGLISH from Metall (East Berlin), v. 15, no. 9, Sep. 1961 p 881-883

(NLL-M-22842-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The microstructure of zinc-copper-titanium alloys is discussed. The effects of addition of various alloying metals on the strength and hardness of as-rolled or annealed material are examined. Procedures for determining the microstructure of the alloys are described. The effects of hot and cold deformation due to metal working are analyzed. Author

N73-20584 National Lending Library for Science and Technology, Boston Spa (England).

THE DAWN OF SOLAR METALLURGY

A. Presnyakov 14 Jul. 1972 3 p Transl. into ENGLISH from Pravda (Moscow), 14 Jul. 1972

(NLL-M-22830-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A vacuum diffusion welding method for joining two different materials is described. The application of solar energy for metallurgical processes is analyzed. It is stated that solar energy can be used to heat any materials, to melt any metals, and to obtain sterile crystals from the metals. The design of a machine for diffusion welding of tubular samples of metal is reported. Author

N73-20585 National Lending Library for Science and Technology, Boston Spa (England).
ELECTRIC ARC WELDING OF TIN AND ALUMINUM BRONZES AND SILICON BRASS
I. P. Doronin and V. M. Sventitskii 4 Dec. 1972 13 p refs Transl. into ENGLISH from Svar. Proizv. (USSR), v. 1, no. 3, Mar. 1955 p 18-21
(NLL-DRIC-Trans-2843-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A silicon-manganese-aluminum complex oxidizer coating on arc welding electrodes and preheating of the components to temperatures of 250 to 400 C provided satisfactory welds of tin and aluminum bronzes and silicon brass. Microstructures of the welded seams showed good fusion of the fused metal with the base metal and freedom from porosity and other defects.
G.G.

N73-20586 National Lending Library for Science and Technology, Boston Spa (England).
INTERGRANULAR CORROSION OF Cr-Ni STAINLESS STEELS
V. Cihal 4 Dec. 1972 23 p refs Transl. into ENGLISH from Corros.-Trait., Prot., Finition (France), v. 18, no. 7, Nov. 1970 p 441-453
(NLL-Risley-TR-2500-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The structural corrosion of Cr-Ni steels is studied. Data cover dissolution and passivation phenomena in relation to the structural state, particularly in the case of 18/8 austenitic steels or derivatives of this type. Results show intercrystalline corrosion appears principally in zones subjected to thermal effects of welded stainless steel joints or after an incorrect heat treatment and a heating over the critical range of temperature, leading to a change in structure which renders the grain boundaries susceptible to corrosion. Chromium carbide precipitation at the grain boundaries was also determined to be a cause of intergranular corrosion.
Author

N73-20587*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF NITROGEN ON TENSILE PROPERTIES AND STRUCTURES OF T-111 (TANTALUM, 8 PERCENT TUNGSTEN, 2 PERCENT HAFNIUM) TUBING
Robert J. Buzzard and Robert R. Metroka Washington Mar. 1973 32 p refs
(NASA-TN-D-6999; E-7285) Avail: NTIS HC $3.00 CSCL 11F

The effect of controlled nitrogen additions was evaluated on the mechanical properties of T-111 (Ta-8W-2Hf) fuel pin cladding material proposed for use in a lithium-cooled nuclear reactor concept. Additions of 80 to 1125 ppm nitrogen resulted in increased strengthening of T-111 tubular section test specimens at temperatures of 25 to 1200 C. Homogeneous distributions of up to 500 ppm nitrogen did not seriously decrease tensile ductility. Both single and two-phase microstructures, with hafnium nitride as the second phase, were evaluated in this study.
Author

N73-20588*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPOSITION EFFECTS ON MECHANICAL PROPERTIES OF TUNGSTEN-RHENIUM-HAFNIUM-CARBON ALLOYS
Walter R. Witzke Washington Mar. 1973 26 p refs
(NASA-TN-D-7210; E-7157) Avail: NTIS HC $3.00 CSCL 11F

The mechanical properties of rod and sheet fabricated from arc melted W-4Re-Hf-C alloys containing up to about 0.8 mol percent hafnium carbide (HfC) were evaluated in the as-worked condition. The DBTT's of electropolished bend and tensile specimens were independent of HfC content in this range but dependent on excess Hf or C above that required for stoichiometric HfC. Low temperature ductility was a maximum at Hf contents slightly in excess of stoichiometric. Variations in high temperature strength were also dependent on excess Hf and C. Maximum creep strengthening also occurred at Hf contents in excess of stoichiometric. Analysis of extracted second phase particles indicated that creep strength was reduced by increasing WC content in the HfC particles.
Author

N73-20589*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
QUANTITATIVE OBSERVATIONS OF HYDROGEN-INDUCED, SLOW CRACK GROWTH IN A LOW ALLOY STEEL
Howard G. Nelson and Dell P. Williams Mar. 1973 58 p refs
(NASA-TM-X-62253) Avail: NTIS HC $5.00 CSCL 11F

Hydrogen-induced slow crack growth, da/dt, was studied in AISI-SAE 4130 low alloy steel in gaseous hydrogen and distilled water environments as a function of applied stress intensity, K, at various temperatures, hydrogen pressures, and alloy strength levels. At low values of K, da/dt was found to exhibit a strong exponential K dependence (Stage 1 growth) in both hydrogen and water. At intermediate values of K, da/dt exhibited a small but finite K dependence (Stage 2), with the Stage 2 slope being greater in hydrogen than in water. In hydrogen, at a constant K, (da/dt) sub 2 varied inversely with alloy strength level and varied essentially in the same complex manner with temperature and hydrogen pressure as noted previously. The results of this study provide support for most of the qualitative predictions of the lattice decohesion theory as recently modified by Oriani. The lack of quantitative agreement between data and theory and the inability of theory to explain the observed pressure dependence of slow crack growth are mentioned and possible rationalizations to account for these differences are presented.
Author

N73-20590*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TECHNIQUES FOR LITHIUM REMOVAL FROM 1040 C AGED TANTALUM ALLOY, T-111
Randall F. Gahn Washington Apr. 1973 17 p refs
(NASA-TM-X-2775; E-7294) Avail: NTIS HC $3.00 CSCL 11F

The liquid ammonia and vacuum distillation techniques were found to be satisfactory for removing lithium from 1040 C aged T-111 (tantalum - 8-percent tungsten- 2-percent hafnium). Results of ductility tests and chemical analysis show that these two methods are adequate for removing lithium without embrittlement or contamination of the T-111. Moist air exposure of T-111 with traces of lithium on the surface produced mixed results. Some specimens were ductile; others were brittle. Brittle T-111 had an increased hydrogen content. Water removal of lithium from T-111 caused brittleness and an increased hydrogen concentration.
Author

N73-20591*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROLE OF PLASTIC DEFORMATION IN WEAR OF COPPER AND COPPER - 10-PERCENT-ALUMINUM ALLOY IN CRYOGENIC FUELS
Robert C. Bill and Donald W. Wisander Washington Apr. 1973 21 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland
(NASA-TN-D-7253; E-7314) Avail: NTIS HC $3.00 CSCL 11F

High-purity copper specimens and a copper-aluminum (10%) alloy specimen were subjected to sliding against Type 440 C in cryogenic fuel environments. It was found that virtually all wear occurred by the plastic deformation of a recrystallized layer extending to about 10 micrometers below the wear scar surface of the copper or copper alloy. The wear debris was in the form of a layered structure adhering to the exit region of the wear scar. Measurements on the high purity copper specimens indicated that the wear rate was proportional to the applied load and to the sliding velocity squared. A physical model of the wear process is proposed to account for these observations.
Author

N73-20592*# Scientific Translation Service, Santa Barbara, Calif.
MICROLOCAL DETERMINATION OF GASES IN METALS BY USING A LASER BEAM
V. I. Yavoyskiy, L. B. Kosterev, and V. L. Safonov Washington NASA Apr. 1973 21 p refs Transl. into ENGLISH from "Proc. of Symp. on Metallurgy and Metal Sciences, Moscow, May, 1968" Moscow, Nauka Press, 1971 p 121-130
(Contract NASw-2483)
(NASA-TT-F-14852) Avail: NTIS HC $3.25 CSCL 11F

A technique using a laser microprobe and a magnetic mass spectrometer is proposed for determining gas contents in metals by melting and vaporizing measured microvolumes of samples and analyzing the gases contained in microvolumes. The technique is used in a study of microinhomogeneities in the distribution of hydrogen through grain cross-sections in cast austenitic and ferrite-pearlite steels and pig iron. Author

N73-20593*# National Aeronautics and Space Administration, Washington, D.C.
METALLURGICAL PROCESSING: A COMPILATION
1973 24 p
(NASA-SP-5953(01)) Avail: NTIS HC $1.00 CSCL 11F

The items in this compilation, all relating to metallurgical processing, are presented in two sections. The first section includes processes which are general in scope and applicable to a variety of metals or alloys. The second describes the processes that concern specific metals and their alloys. Author

N73-20594# McElroy (Ralph) Co., Austin, Tex.
STUDY OF PREFERRED ORIENTATION OF HEXAGONAL METALS WITH SUBCRITICAL VALVES C/A
F. Volf [1972] 36 p refs Transl. into ENGLISH from Czech report Sponsored by AEC
(RFP-Trans-117) Avail: NTIS

Research directed to the development of X-ray crystallographic methods is reported. The methods are designed to determine the preferred orientation of hexagonal metals and their applicability in zirconium and magnesium rods acquired through mechanical formation by various degrees of deformation. For zirconium, where changes in form are noted after irradiation and anisotropy, single crystal thermal expansion is accomplished by computation of variable characteristics of growth index and the coefficient of thermal expansion from measurements of preferred orientations. Results of investigations were basis for selection of the Harrison method, primarily developed for determining the texture of uranium, for adaptation to use with zirconium and magnesium. NSA

N73-20595# Battelle Columbus Labs., Ohio.
OXIDATION AND HOT CORROSION OF Ni-Cr- AND Cr-BASE ALLOYS CONTAINING RARE EARTH OXIDE DISPERSIONS Final Report, 3 Dec. 1971 - 3 Dec. 1972
Ian G. Wright, Ben A. Wilcox, and Robert I. Jaffee 30 Jan. 1973 161 p refs
(Contract N00019-72-C-0190)
(AD-754760) Avail: NTIS CSCL 11/6

The effects of dispersions of the oxides Y_2O_3, ThO_2 and Al_2O_3 on the oxidation and hot corrosion of Ni-20% Cr-base alloys, and of dispersions of Y_2O_3 on the oxidation and hot corrosion of Co-Cr-base alloys have been studied. Up to 1100C, dispersions of Y_2O_3, ThO_2, and possibly Al_2O_3 have very similar effects on the oxidation of Ni-20% Cr-base alloys. Author (GRA)

N73-20596# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy and Materials Science.
INVESTIGATION OF SOLIDIFICATION OF HIGH STRENGTH STEEL Technical Report, 1 Jan. 1971 - 31 Dec. 1971
D. S. Gnanamuthu, M. Basaran, T. Z. Kattamis, R. Mehrabian, and M. C. Flemings Aug. 1972 83 p refs
(Contract DAAG46-68-C-0043; DA Proj. 1T0-62105-A-328)
(AD-753958; AMMRC-CTR-72-6/1) Avail: NTIS CSCL 11/6

The first part of the work describes the effect of homogenization, of unidirectionally solidified AISI 4340 low alloy steel, under high isostatic pressure (in excess of 20,000 psi) on volume percent and geometry of microporosity. Measurements were made using a microradiographic technique. The second part of the report contains results from a study of the effect of homogenization on the morphology of inclusions in unidirectionally solidified iron ingots containing a single type of sulfides. Author (GRA)

N73-20597# Naval Ship Research and Development Center, Annapolis, Md.
AN INVESTIGATION OF YTTRIUM OXIDE AS A CRUCIBLE MATERIAL FOR MELTING TITANIUM Research and Development Report
R. L. Helferich and C. A. Zanis Jan. 1973 29 p refs
(ZFXX412)
(AD-754092; NSRDC-28-409; NSRDC-3911) Avail: NTIS CSCL 11/6

The feasibility of using yttrium oxide as a crucible material for induction melting of titanium was investigated. Melting experiments using 10- and 30-gram capacity yttrium oxide crucibles led to the conclusion that molten titanium partially dissociates the yttrium oxide resulting in limited interstitial oxygen contamination of the titanium and in the formation of a titanium-yttrium-oxygen eutectic phase in the cast microstructure. Variation in the crucible density over the range of 70% to 97% of theoretical had no measurable effect on the extent of melt contamination. However, it was noted that melts prepared in oxygen deficient crucibles generally had the highest levels of contamination. Although up to 1.93% yttrium and 0.56% oxygen were picked up from the crucibles, comparison of the results reported in this investigation to those of previous studies on refractory oxides, indicates that yttrium oxide appears to be the best candidate crucible material for melting titanium. Author (GRA)

N73-20598# Army Materials and Mechanics Research Center, Watertown, Mass.
THE FRACTURE TOUGHNESS OF THREE HEAVY SECTION TITANIUM ALLOYS
Richard Chait and Thomas S. DeSisto Oct. 1972 19 p refs
(AD-753919; AMMRC-PTR-72-5) Avail: NTIS CSCL 11/6

The study is concerned with the influence of microstructural variables on the fracture toughness of the following heat-treated titanium alloys in heavy sections: Ti-6Al-4V, Ti-6Al-6V-2Sn, and Ti-8Mo-8V-2Fe-3Al. Author (GRA)

N73-20599# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
HIGH TEMPERATURE SPECIFIC HEAT OF TITANIUM AND TITANIUM-BASE ALLOYS Technical Report, 1 Apr. 1970 - 31 Jul. 1972
Richard L. Ward, Michael Hoch, L. R. Bidwell, and H. L. Gegel Sep. 1972 84 p refs
(Contract F33615-70-C-1407; AF Proj. 7351)
(AD-754954; AFML-TR-72-186) Avail: NTIS CSCL 11/6

The high temperature heat content relative to 300 K of Pt, Ti, Ti(0.787)Al(0.213), Ti(0.747)Ga(0.253), Ti(0.828)Al(0.101)Ga (0.071), and Ti(0.862)Al(0.071)Ga(0.067) was measured between 450 and 1000 K using a diphenyl ether drop-calorimeter. Author (GRA)

N73-20600# Pennsylvania State Univ., University Park. Materials Research Lab.
INTERFACE REACTION OF NICKEL-OXIDE ON STEEL
Frank Dachille and Steve Stanic 18 Jan. 1973 18 p
(Contract N00014-67-A-0385-0002; NR Proj. 032-502)
(AD-754776; TR-8) Avail: NTIS CSCL 11/6

In vacuum or an argon atmosphere, nickel oxide reacts with steel at 600 to 750C to form a surface layer of gamma-NiFe which affords corrosion protection to the steel in air and warm humid conditions. Author (GRA)

N73-20601# General Electric Co., Schenectady, N.Y.
TECHNOLOGY DEVELOPMENT FOR TRANSITION METAL-RARE EARTH HIGH PERFORMANCE MAGNETIC MATERIALS Semiannual Interim Technical Report, 1 Jan. - 30 Jun. 1972
Joseph J. Becker Sep. 1972 54 p refs
(Contract F33615-70-C-1626; ARPA Order 1617)
(AD-754959; SRD-72-1; AFML-TR-72-187; SITR-4) Avail: NTIS CSCL 11/6

A session that has been organized for the 1972 Magnetism Conference will review work done under this contract and elsewhere on the problem of the origin of the coercive force in high-anisotropy materials. Polarized light metallography has been used to study magnetic domain configurations in Co5Sm, Co5Y, Co5Ce, and Co5Pr as a function of crystal thickness. Magnetic domain structures in several Co17R2, (Co,Fe)17R2, and Co7R2 phases have been examined using polarized light. The magnetic moment and hysteresis properties of a high-density, nearly completely oriented Co5Sm magnet alloy have been measured from 300K to 4.2K and in applied fields up to 140 kOe. The

demagnetization properties of a series of sintered Co-Sm magnets have been measured over the range 0 to 750K. Saturation magnetization, intrinsic coercive force, anisotropy field, and anisotropy constants were determined for a sample of sintered Co5Sm at 4.2, 77, 300, and 500K. The relationship between the temperature dependence of the coercivity and the anisotropy parameters is discussed. GRA

N73-20602# Watervliet Arsenal, N.Y.
RAPIDLY AUSTENITIZED LOW CARBON STEEL
Richard B. Griffin and Joseph Pepe Oct. 1972 36 p refs
(DA Proj. 1T0-62105-A-32B)
(AD-753928; WVT-7252) Avail: NTIS CSCL 11/6

A 1010 carbon steel, in the annealed condition, was used to study the dissolution behavior of Fe3C particles under conditions of rapid heating and short times at temperature. The study used a capacitor-discharge pulse heating and quenching system to achieve heating rates of 1,000,000 C/sec, quenching rates of 10,000 C/sec, and times at temperatures from 15 to 500 msec. A qualitative description is given of the effect pulse heating of alloys, into the two phase (ferrite plus austenite) and into the single phase (austenite region), have on the samples. Metallographic evidence is presented confirming the suggestion that pulse heating and rapid quenching can produce regions having higher carbon concentrations than the same alloy heated under equilibrium conditions. Author (GRA)

N73-20603# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF REVERSIBILITY ON EXOEMISSION AND CORROSION OF STEEL
V. D. Evdokimov and V. I. Ryaboshapchenko 26 Dec. 1972 13 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (Moscow), no. 4, 1971 p 142-144
(AF Proj. 7351)
(AD-754666; FTD-HT-23-1411-72) Avail: NTIS CSCL 11/6

The report presents experimental data on the effect of reverse abrasive friction on the initial oxidation stage of steel and on exoelectron emission. Author (GRA)

N73-20604# Watervliet Arsenal, N.Y.
SHEAR INSTABILITIES AND THE TENSILE FRACTURE CHARACTERISTICS OF A COLD WORKED 1080 PEARLITIC STEEL
J. Pepe Nov. 1972 45 p refs
(DA Proj. 1T0-62105-A-328)
(AD-755102; WVT-7257) Avail: NTIS CSCL 11/6

A study was conducted to establish the existence of regions of microscopic shear inhomogeneities resulting from cold working and to determine the interaction of such regions with the subsequent tensile fracture characteristics of the cold worked material. Using 1080 pearlitic steel as a vehicle of study, microscopic regions of intense shear deformation were observed to result from cold deformation. Metallographic examination of the tensile fracture behavior of this material in several conditions of cold work clearly establishes the interaction of deformation induced shear instabilities and the subsequent fracture characteristics of the deformed material. Author (GRA)

N73-20605# Army Foreign Science and Technology Center, Charlottesville, Va.
DEFORMATION OF INTERMETALLIC COMPOUNDS BY AN EXTRUSION METHOD
K. M. Nurbaev 6 Jul. 1972 8 p refs Transl. into ENGLISH from Yadern. Fiz. (USSR), no. 10, 1969 p 131-135
(AD-754523; FSTC-HT-23-1102-72) Avail: NTIS CSCL 11/6

Closley packed, hexagonal epsilon-phases may be easily deformed by the extrusion method to comparatively large degrees of deformation above 0.7 to 0.8 of absolute melting temperature. The gamma-phases which are brittle at room temperature may be deformed in the hot state to extremely high degrees of deformation without destruction. In addition the temperatures of transition from the brittle into the plastic state are 0.9 to 0.97 of absolute melting temperature for the gamma-phases. Based on the results of all work and data in the literature, the authors propose the possibility of extrusion of the nickel-arsenide type and Laves phases under appropriate experimental conditions. Author (GRA)

N73-20606# Frankford Arsenal, Philadelphia, Pa.
NEW PROCESSING TECHNIQUES FOR ALUMINUM ALLOYS
Jeffrey Waldman, Harry Sulinski, and Harold Markus Oct. 1972 39 p refs Presented at the Army Mater. Technol. Conf. on Solidification Technol., Wentworth-By-The Sea, N. H., 22-25 Oct. 1972
(DA Proj. 1T0-62105-A-328)
(AD-754571; FA-A72-5) Avail: NTIS CSCL 11/6

The paper describes recent significant accomplishments in three areas of processing research on high strength aluminum alloys: (1) solidification and homogenization, (2) ingot processing and (3) thermal mechanical treatments. Author (GRA)

N73-20607# Bureau of Mines, Albany, Oreg.
REDUCING SURFACE HOT SHORTNESS OF COPPER BEARING STEELS
Mark I. Copeland and John E. Kelley Washington Sep. 1972 25 p refs
(PB-212660; BM-RI-7682) Avail: NTIS HC $3.00 CSCL 11F

Silicon additions to steel and borax-glass coatings were found by microscopic examination to prevent the formation of molten copper on the surface of steel when heated to 1,300C in oxidizing atmospheres. By formation of copper in the scale instead of on the steel surface, surface, hot shortness during hot working of steel could be prevented. Fayalite (Fe2SiO4), forming on the steel surface by internal oxidation of silicon additions and melting at 1,205C, prevented copper formation when liquid but not when solid. Borax-glass coatings were also effective by forming molten, complex borax compounds on the steel surface. Author (GRA)

N73-20692 Queen Mary Coll., London (England). Dept. of Materials.
MICROPLASTICITY IN MATERIALS FOR INERTIAL NAVIGATION SYSTEMS
William Bonfield *In* AGARD Inertial Navigation Components and Systems Feb. 1973 6 p refs (For availability see N73-20684 11-21)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N73-20608*# IIT Research Inst., Chicago, Ill. Technology Center.
TESTING TO DETERMINE THE VACUUM-ULTRAVIOLET DEGRADATION RATE OF THERMAL CONTROL COATINGS Final Report, 5 May - 25 Nov. 1972
J. E. Gilligan 27 Nov. 1972 20 p
(Contract NAS8-28765; IITRI Proj. C6258)
(NASA-CR-124149; IITRI-C6258-5) Avail: NTIS HC $3.00 CSCL 11C

Samples of S-13G that had been exposed to the salt air environment of Cape Kennedy, Florida were irradiated with simulated solar ultraviolet radiation after various cleaning treatments. In both of the the tests conducted two of the salt air exposed samples were not cleaned, two were lightly cleaned with water and detergent (i.e. rinsed), and two were vigorously scrubbed. Several other white thermal control coatings were also irradiated. The solar absorptance values of these coatings before and as a result of the ultraviolet irradiation are reported for exposure levels up to approximately 2000 ESH. Author

N73-20609*# General Dynamics/Convair, San Diego, Calif.
PREPARATION OF COMPOSITE MATERIALS IN SPACE. VOLUME 2: TECHNICAL REPORT Final Report
W. H. Steurer and S. Kaye Jan. 1973 192 p refs
(Contract NAS8-27806)
(NASA-CR-124172; GDCA-DBG73-001-Vol-2) Avail: NTIS HC $11.75 CSCL 11D

A study to define promising materials, significant processing criteria, and the related processing techniques and apparatus for

the preparation of composite materials in space was conducted. The study also established a program for zero gravity experiments and the required developmental efforts. The following composite types were considered: (1) metal-base fiber and particle composites, including cemented compacts, (2) controlled density metals, comprising plain and reinforced metal foams, and (3) unidirectionally solidified eutectic alloys. A program of suborbital and orbital experiments for the 1972 to 1978 time period was established to identify materials, processes, and required experiment equipment. Author

N73-20610*# Grumman Aerospace Corp., Bethpage, N.Y.
INVESTIGATION OF KC-135 FLIGHT SAMPLES SOLIDIFIED IN NEAR-ZERO GRAVITY
D. Larson, Jr. and G. Busch Jan. 1973 36 p refs
(Contract NAS8-28728)
(NASA-CR-124179; RM-566) Avail: NTIS HC $4.00 CSCL 11D

An analysis was conducted of three KC-135 flight samples that had been solidified in near-zero gravity. These samples had been generated during near-zero gravity testing of M553 experiment Skylab flight hardware. The samples evaluated were all Star-J Satellite, a cobalt base alloy. The analytical procedures (optical microscopy, scanning electron microscopy, electron microprobe, X-ray diffraction, differential scanning calorimetry, and microhardness) to be use on the Skylab flight samples were optimized and the analytical results are presented. Author

N73-20611*# Boeing Co., Seattle, Wash. Aerospace Group.
DEVELOPMENT OF POLYPHENYLQUINOXALINE GRAPHITE COMPOSITES Contract Report, 1 Jul. 1971 - 30 Sep. 1972
J. T. Hoggatt, P. M. Hergenrother, and J. G. Shdo Jan. 1973 140 p refs
(Contract NAS3-15547)
(NASA-CR-121109; BAC-2-5540) Avail: NTIS HC $9.00 CSCL 11D

The potential of polyphenylquinoxaline (PPQ)/graphite composites to serve as structural material at 316 C (600 F) has been demonstrated using a block copolymer, BICo(13), PPQ derivative. Initially, thirteen polyphenylquinoxalines were evaluated. From this work, four candidate polymers were selected for preliminary evaluation as matrices for HMS graphite fiber reinforced composites. The preliminary composite evaluation enabled selection of one of the four polymers for advanced composite preparation and testing. Using an experimentally established cure schedule for each of the four polymers, preliminary laminates of 50% resin volume content, prepared without postcure, were tested for flexure strength and modulus, interlaminar shear strength (short beam), and tensile strength and modulus at ambient temperature. A block copolymer (BI Co 13) derived from one mole p-bis (phenylglyoxalyl) benzene, one fourth mole 3,3'-diaminobenzidine and three-fourths mole 3,3', 4,4'-tetraminobenzophenone was selected for extensive study. Tensile, flexural, and interlaminar shear values were obtained after aging and testing postcured BICo(13) laminates at 316 C (600 F). The potential of PPQ/graphite laminates to serve as short term structural materials at temperatures up to 371 C (700 F) was demonstrated through weight loss experiments. Author

N73-20612*# Sperry Rand Research Center, Sudbury, Mass.
LAYERED OPTICAL MEMORY MATERIAL
J. B. Thaxter, M. Kestigian, and W. T. Maloney [1972] 49 p refs
(Contract NAS1-11464)
(NASA-CR-112261; SRRC-CR-72-15) Avail: NTIS HC $4.50 CSCL 11D

Experimental measurements which demonstrate unique properties of strontium barium niobate that allow a layered optical memory to be realized are presented. The extremely high recording sensitivity of this material, coupled with its unique electrically controlled latent-to-active reconstruction property, allows electrical layer selection within the memory. The layered structure provides a means for enlarging the memory capacity by one or two orders of magnitude without the loss in reading rate. An experimental model of the layered memory was constructed to demonstrate the interrelation of several concepts. The successful operation of this model demonstrates the validity of this approach. Author

N73-20613*# Solar, San Diego, Calif.
DEVELOPMENT OF FUSED SLURRY SILICIDE COATINGS FOR TANTALUM REENTRY HEAT SHIELDS Final Report
R. V. Warnock and A. R. Stetson 21 Sep. 1972 192 p refs
(Contract NAS3-14315)
(NASA-CR-121022; RDR-1685-7) Avail: NTIS HC $11.75 CSCL 11D

A fused slurry silicide coating was developed to provide atmospheric reentry protection for the 90Ta-10W alloy. Overlaying the silicide with a highly refractory glass greatly improved total lifetime and reliability of the coating system. Low-pressure, slow-cycle lifetimes in excess of 100 cycles were consistently recorded for 1700 K - 13 and 1300 N/sqm test conditions. A minimum of 25 cycles was obtained for 1810 K - 1300 N/sqm conditions. About 50 simulated reentry cycles (variable temperature, pressure, and stress) were endured by coated 1-inch x 4-inch miniature heat shield panels when exposed to a maximum of 1700 K and either internal or external pressure conditions. Author

N73-20614# Committee on Aeronautical and Space Sciences (U. S. Senate).
USE OF RECYCLED MATERIALS BY NASA
Washington GPO 1972 31 p refs Hearing on S. 2190 before Comm. on Aeronaut. and Space Sci., 92d Congr., 2d Sess., 27 Jun. 1972
Avail: Comm. on Aeronaut. and Space Sci.

The proceedings of a Congressional hearing concerning the use of recycled materials in NASA procurement and construction are presented. Four categories of NASA programs are discussed to show their impact on recycling of materials and environment improvement. The report consists mainly of statements by government witnesses concerning recycling legislation and necessity for improving recycling practices. P.N.F.

N73-20615*# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
DEVELOPMENT OF DESIGN ALLOWABLES DATA FOR ADHESIVES FOR ATTACHING REUSABLE SURFACE INSULATION Final Technical Report, 17 Jan. - 30 Sep. 1972
H. P. Owen and M. T. Carroll Oct. 1972 262 p refs
(Contract NAS9-12392)
(NASA-CR-128887) Avail: NTIS HC $15.25 CSCL 11A

Results are presented from tests to establish design allowables data for the following room temperature vulcanizing (RTV) silicone rubber based adhesives: (1) General Electric's RTV-560; (2) Dow Corning's 93-046; and (3) Martin Marietta's SLA-561. These adhesives are being evaluated for attaching reusable surface insulation to space shuttle structure. Author

N73-20616*# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
DEVELOPMENT OF DESIGN ALLOWABLES DATA FOR ADHESIVES FOR ATTACHING REUSABLES SURFACE INSULATION, ADDENDUM 1A Final Technical Report
H. P. Owen and M. T. Carroll 12 Feb. 1973 50 p
(Contract NAS9-12392)
(NASA-CR-128888) Avail: NTIS HC $4.50 CSCL 11A

The task consisted of conducting mechanical and thermal tests to establish design allowables data on a new room temperature vulcanizing (RTV) silicone adhesive, X3-6004. Low modulus, coupled with relatively low density and good low-temperature properties of this adhesive, places it in contention as a candidate for attaching reusable surface insulation on the space shuttle. Data obtained show that the modulus values of X3-6004 are significantly lower than those of RTV-560 and the other three adhesives characterized at test temperatures from 550 to -175 F. At -175, -200 and -270 F, the modulus of X3-6004 is approximately the same as GE RTV-560 and the other three silicone adhesives. The X3-6004 adhesive exhibits good processing properties. It has a 12 percent lower density than RTV-560. Although lower in overall strength properties as compared to the other adhesives in the program, X3-6004 has

adequate adhesion to 2024T81 aluminum to compete as an adhesive for attaching reusable surface insulation. It does exhibit some tendency to revert and soften at temperatures above 350 F when in a confined area. Author

N73-20617*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE NONLINEAR BEHAVIOR OF ANGLEPLIED BORON/ ALUMINUM COMPOSITES
C. C. Chamis and T. L. Sullivan 1973 23 p refs Presented at the 3d Symp. on Composite Mater.: Testing and Design, Williamsburg, Va., 19-23 Mar. 1973; sponsored by Am. Soc. for Testing and Mater.
(NASA-TM-X-68205; E-7378) Avail: NTIS HC $3.25 CSCL 11D

Specimens from angleplied laminates of boron/aluminum composites were tested and the results analyzed. The specimens consisted of eight-ply symmetric layups and were loaded in tension at various angles to the 0 deg-ply direction. Stress-strain curves to specimen fracture were obtained. The analysis was performed using linear composite mechanics which includes residual stresses and a combined stress yield function. The results obtained indicate that angleplied boron/aluminum laminates exhibit a nonlinear stress-strain behavior to fracture. The residual stresses affect the initial and yield laminate properties. Linear composite mechanics is inadequate to predict the mechanical behavior of boron/aluminum angleplied laminates. Author

N73-20618# National Research Corp., Cambridge, Mass.
DEVELOPMENT OF RIBBON REINFORCED TITANIUM MATRIX COMPOSITES Final Report, 16 Apr. - 15 Oct. 1972
M. J. Hordon Nov. 1972 43 p refs
(Contract N00019-72-C-0445)
(AD-754478; Rept-72-NRC-13) Avail: NTIS CSCL 11/4

Boron carbide-ribbon reinforced titanium composites were fabricated by modifying a lamination process comprising the formation of B4C-Ti layers 0.001 inch in depth and diffusion bonding laminate assemblies at 700C and 8000-10,000 psi pressure for two hours in vacuum. Composites containing uniaxially aligned arrays of B4C ribbon elements with cross-section ratios varying from 50 to 1000 demonstrated improved transverse mechanical properties compared to equivalent fiber-reinforced products. Transverse elastic modulus and fracture stress modulus values varying from 75-100 percent of corresponding axial values were measured depending on ribbon geometry. The experimental results were in good agreement with data derived from theoretical analysis. GRA

N73-20619# Watervliet Arsenal, N.Y.
EFFECTIVE MODULUS PLATE THEORIES WITH APPLICATION TO THE PLATE STRIP
Charles R. Thomas Sep. 1972 95 p refs
(DA Proj. 1F0-61102-A-35D)
(AD-754528; WVT-7251) Avail: NTIS CSCL 11/4

An effective modulus theory is obtained by a direct reduction from the velocity corrected Sun (effective stiffness) theory by setting all microstructure terms to zero. Two additional theories are obtained by reducing the Mindlin plate theory for ortho-tropic materials to a transversely isotropic theory with Postma elastic constants and by separately considering the cases of velocity correction and shear correction of the resulting theory. Numerical results for and comparisons of three theories are presented. Author (GRA)

N73-20620# Monsanto Research Corp., St. Louis, Mo.
MOLDING OF ORIENTED SHORT FIBER COMPOSITES. 1: ULTIMATE TENSILE PROPERTIES
Lloyd A. Goettler Dec. 1972 69 p refs
(Contract N00014-67-C-0218; ARPA Order 876)
(AD-754763; HPC-72-149) Avail: NTIS CSCL 11/4

Several aspects of composite structure that affect the mechanical performance of polymers reinforced with short fibers are fiber length, fiber concentration, void content, dispersion of fibers, fiber orientation, and wetting. The report describes the dependence of these structural variables on the molding compound composition and on the processing conditions for flow (plunger) moldings of epoxy resin reinforced with short glass fibers. The methods used in the study for characterizing the composite structure are also presented. Author (GRA)

N73-20621# California Univ., Los Angeles. School of Engineering and Applied Science.
AN EXPERIMENTAL STUDY ON THE COMPRESSIVE BIAXIAL STRENGTH OF CERAMICS Annual Technical Report, 9 Nov. 1971 - 31 Oct. 1972
George Sines and Marc Adams Nov. 1972 44 p refs
(Contract N00019-72-C-0159)
(AD-754826; UCLA-ENG-7297; ATR-2) Avail: NTIS CSCL 11/2

Four successful 2:1 biaxial compression tests were performed on Wesgo AL-995 alumina. The average strength measured was 572,000 psi with very little scatter (standard deviation 7 ksi) in the data. This value is 28% greater than the greatest uniaxial strength reported for this material. A testing technique was developed which minimizes the damage done to the specimen on fracture, permitting subsequent examination of the fractured material. The design and fabrication of a 1:1 biaxial compression test device is described. Preliminary tests performed with this device indicate that it has a good probability of being capable of breaking the test specimen in the desired stress state. Author (GRA)

N73-20622# Explosives Research and Development Establishment, Waltham Abbey (England).
SOME MECHANICAL AND PHYSICAL PROPERTIES OF DISCONTINUOUS CARBON FIBRE REINFORCED PLASTICS
L. E. Dingle and H. Edwards May 1972 46 p refs
(AD-754034; ERDE-TR-81; BR-31652) Avail: NTIS CSCL 11D

Thermoset composites were made from prepregs of 3 mm long, high modulus and high strength carbon fiber. Some mechanical and physical properties of these composites have been measured and compared with values obtained for continuous carbon fiber composites made from the same batches of fiber. In most cases the properties of discontinuous fibre composites made by this process were similar to those obtained with continuous fibre except for flexural and tensile strength which exhibited a reduction of 30 to 40 percent when using short fibres. The properties of planar pseudo-isotropic composites made from discontinuous fibre pseudo-random mats were shown to be markedly superior to those for random carbon fibre composites. Author (GRA)

N73-20623# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AK-4 ANTIFRICTION PLASMA COATINGS
P. F. Truskov, Yu. M. Kovalchuk, V. G. Panamarchuk, and V. S. Onopko Nov. 1972 11 p refs Transl. into ENGLISH from Tekhnol. Organ. Proizvod. (Ukrainia SSR), no. 1, 1971 p 71-72
(AD-753985; FTD-HT-23-1067-72) Avail: NTIS CSCL 11/3

The technological process for obtaining a bronze coating on samples made of AK-4 alloy in an argon atmosphere is described. The plasma coating process makes it possible to obtain coatings with adhesion from 90 to 136 kg/sq cm. Author (GRA)

N73-20624# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE STRUCTURE AND PROPERTIES OF POLYAMIDE S-6
T. M. Rogatkina, V. I. Aleksenko, V. M. Rubshtein, and T. I. Sogolova 1 Dec. 1972 13 p refs Transl. into ENGLISH from Kozh.-Obuvn. Prom. (Moscow), v. 13, no. 7, 1971 p 49-52
(AF Proj. 7360)
(AD-753967; FTD-HT-23-1123-72) Avail: NTIS CSCL 11/9

The report presents studies on electron microscopy, X ray, diffraction patterns, and IR spectra of polyamide S-6 (Nylon 6). It was found to be a crystalline polymer having a spherulitic structure. GRA

N73-20625# United Aircraft Corp., East Hartford, Conn.
ABSTRACTS FROM CONFERENCE ON IN SITU COMPOSITES
E. R. Thompson Jan. 1973 34 p Conf. held at Lakeville, Conn., 5-8 Sep. 1972

(Contract N00014-71-C-0393; NR Proj. 031-747)
(AD-754779; M911364-1) Avail: NTIS CSCL 11/4

The purpose of the conference was to examine new findings and technologically significant developments in the field of directionally grown composites of eutectic, off-eutectic, complex eutectic and eutectoid alloys. Author (GRA)

N73-20626# North American Rockwell Corp., Thousand Oaks, Calif. Science Center.
ACOUSTIC EMISSION FROM POLYCRYSTALLINE CERAMICS Final Report, 25 May - 22 Dec. 1972
Lloyd J. Graham and George A. Alers 22 Dec. 1972 86 p refs
(Contract N00019-72-C-0382)
(AD-754839; SC531.7FR) Avail: NTIS CSCL 11/2

The principal objective was to see if some characteristic feature in the frequency spectrum of an individual burst or in the amplitude distribution of a series of bursts could be found and related to the microstructure or type of the ceramic. Also, it was hoped that a relationship between the rate of emission generation could be correlated with the rate of fracture of individual grains during the advance of the crack front. This report describes the results obtained when slow crack growth was induced in samples of polycrystalline magnesia, alumina, Lucalox, and spinel, as well as when attempts were made to produce slow crack growth in silicon nitride. Author (GRA)

N73-20627# Army Materials and Mechanics Research Center, Watertown, Mass.
SOME ATOMISTIC OBSERVATIONS ON THE ROLE OF TITANIUM IN MAGNESIUM-GRAPHITE FIBER COMPOSITES
Marc H. Richman (Brown Univ.), Albert P. Levitt, and Eugene DiCesare Oct. 1972 20 p refs
(DA Proj. 1T0-62105-A-331)
(AD-754570; AMMRC-TR-72-32) Avail: NTIS CSCL 11/4

Titanium, when used as a fiber coating, has been found to effectively promote wetting and bonding between graphite fibers and magnesium, thereby permitting the fabrication of magnesium-graphite fiber composites having significantly improved strength and stiffness. This report presents an atomistic analysis of the role of titanium in this composite system. To this end, the fiber-matrix interfacial compounds that could be formed when molten magnesium is brought into contact with Ti-coated graphite fibers are deduced from atomistic, thermodynamic, and crystallographic data. Comparison of theory and experiment indicates that the sound bonding attained in this system could result from any of the possible atomistic hypotheses proposed. This analysis provides a basis for understanding the mechanisms by which excellent fiber-matrix wetting and bonding have been achieved by the use of a titanium intermediate layer in the fabrication of this composite system. Author (GRA)

N73-20628# Naval Ordnance Lab., White Oak, Md.
ULTRASONIC RELAXATION NEAR THE MELTING POINT OF POLYETHYLENE AND POLYETHYLENE OXIDE
Bruce Hartmann and Jacek Jarzynski 26 Oct. 1972 15 p refs
(AD-754391; NOLTR-72-212) Avail: NTIS CSCL 11/9

Ultrasonic absorption measurements were made on polyethylene and polyethylene oxide at 5.5 MHz from room temperature to above the melting point. Both polymers have a relaxation peak near the melting point. Comparison of this data with literature values suggests that both peaks are due to the alpha relaxation, and that the activation energy for the alpha relaxation in polyethylene oxide is 40 kcal/mole. Author (GRA)

N73-20629# Pennsylvania State Univ., University Park. Materials Research Lab.
GLASSY CARBON, ALLOYS Semiannual Technical Report, 1 Jul. - 31 Dec. 1972
P. L. Walker, Jr. 27 Jan. 1973 61 p
(Contract DAHC15-71-C-0290)
(AD-755146; SATR-3) Avail: NTIS CSCL 11/2

During the period, work has been performed in the following areas: Compositional and structural modification of glassy carbon by addition of iron; Pressure polymerization and carbonization of glassy carbon under pressure; Glassy carbons with open macroporosity; Small angle X-ray scattering by glassy carbons; Binary carbide glasses. Details of progress in these areas are given in the report. GRA

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N73-20630 National Lending Library for Science and Technology, Boston Spa (England).
CONSTRUCTION OF A CONTINUOUS STEADY STATE RATE FIELD IN BI-CYLINDRICAL COORDINATES
V. I. Tarnovskii, G. L. Feigin et al [1972] 13 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), v. 7, 1972 p 69-73
(NLL-M-21519-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A method is presented for constructing a kinematically possible field in plane steady-state plastic flow in a region limited by a curvilinear surface. The deformation zone is divided into three regions, the flow in which is described in bipolar and polar coordinates. The hypothesis of the coincidence of flow lines in each region with one of the families of coordinate lines of the orthogonal system of curvilinear coordinates is utilized in the construction. The continuity of the constructed field is demonstrated and it is shown to be suitable for describing the different processes of treatment of metals by pressure. Author

N73-20631*# Brown Univ., Providence, R.I. Center For Dynamical Systems.
FIXED POINT THEOREMS AND DISSIPATIVE PROCESSES
Jack K. Hale and Orlando Lopes [1972] 22 p refs
(Grants NGL-40-002-015; AF-AFOSR-2078-71; DA-ARO(D)-31-124-71-G12S2)
(NASA-CR-131267) Avail: NTIS HC $3.25 CSCL 12A

The deficiencies of the theories that characterize the maximal compact invariant set of T as asymptotically stable, and that some iterate of T has a fixed point are discussed. It is shown that this fixed point condition is always satisfied for condensing and local dissipative T. Applications are given to a class of neutral functional differential equations. J.M.M.

N73-20632*# Maryland Univ., College Park. Computer Science Center.
REPRESENTATIONS OF THE LANGUAGE RECOGNITION PROBLEM FOR A THEOREM PROVER
Jack Minker and Gordon J. VanderBrug Sep. 1972 55 p refs
(Grant NGR-21-002-270)
(NASA-CR-131402; TR-199) Avail: NTIS HC $4.75 CSCL 12A

Two representations of the language recognition problem for a theorem prover in first order logic are presented and contrasted. One of the representations is based on the familiar method of generating sentential forms of the language, and the other is based on the Cocke parsing algorithm. An augmented theorem prover is described which permits recognition of recursive languages. The state-transformation method developed by Cordell Green to construct problem solutions in resolution-based systems can be used to obtain the parse tree. In particular, the end-order traversal of the parse tree is derived in one of the representations. An inference system, termed the cycle inference system, is defined which makes it possible for the theorem prover to model the method on which the representation is based. The general applicability of the cycle inference system to state space problems is discussed. Given an unsatisfiable set S, where each clause has at most one positive literal, it is shown that there exists an input proof. The clauses for the two representations satisfy these conditions, as do many state space problems. Author

N73-20633*# California Univ., Berkeley. Dept. of Electrical Engineering and Computer Sciences.
A MODIFIED SECANT METHOD FOR UNCONSTRAINED

MINIMIZATION
E. Polak [1972] 17 p refs
(Grant NGL-05-003-016; Contract F44620-71-C-0087; Grant NSF GK-1065X2)
(NASA-CR-131396) Avail: NTIS HC $3.00 CSCL 12A

A gradient-secant algorithm for unconstrained optimization problems is presented. The algorithm uses Armijo gradient method iterations until it reaches a region where the Newton method is more efficient, and then switches over to a secant form of operation. It is concluded that an efficient method for unconstrained minimization has been developed, and that any convergent minimization method can be substituted for the Armijo gradient method. F.O.S.

N73-20634*# Harvard Univ., Cambridge, Mass. Center for Research in Computing Technology.
THE INCLUSION PROBLEM FOR MONADIC RECURSION SCHEMES
Emily Perlinski Friedman 24 Jan. 1973 20 p refs
(Grants NGR-22-007-176; NSF GJ-30409)
(NASA-CR-131292; Rept-2-73) Avail: NTIS HC $3.00 CSCL 12A

The inclusion problem for the class of monadic recursion schemes is shown to be undecidable. The proof illustrates the close relationship between monadic recursion schemes and deterministic pushdown automata. The proof is extended to show that both the weak equivalence problem for the class of monadic recursion schemes and the weak equivalence problem for the class of free schemes without identity are undecidable. Author

N73-20635# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
A USER'S GUIDE TO THE OMNITAB COMMAND STATISTICAL ANALYSIS
H. H. Ku Mar. 1973 42 p refs
(NBS-TN-756) Avail: SOD $0.75 domestic postpaid or $0.50 GPO Bookstore

Interpretive notes for a number of commands in the OMNITAB system that have the automatic printout feature are presented. These notes aim to be self contained so that users may have sufficient information on hand for the understanding of the statistics computed and to use them for their immediate applications. Computation formulas are given in the text, and a number of statistical tables are reproduced. Author

N73-20636# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
ON LINEAR DEPENDENCE AND THE PROJECTED GRADIENT METHOD
R. Sharma and W. A. Gruver 1973 15 p refs
(DLR-FB-73-26) Avail: NTIS HC $3.00; DFVLR Porz-Wahn: 7.20 DM

It is proved that, in spite of linear dependence of the gradients of the active constraint tangent planes, there exists a unique projection operator. This operator is formed from any linearly independent subset of the gradients. The results are also established for projection relative to a nonorthogonal inner product and the relation to nonlinear optimization and to a simplified version of the projected gradient method. Author

N73-20637*# Scientific Translation Service, Santa Barbara, Calif.
ARGUMENTS ON A GROUP OF SYMPLECTIC MATRICES
V. A. Yakubovich Washington NASA Feb. 1973 44 p refs Transl. into ENGLISH from Mat. Sb. (USSR), v. 55, issue 97, 1961 p 255-280
(Contract NASw-2483)
(NASA-TT-F-14806) Avail: NTIS HC $4.25 CSCL 12A

It is shown that any continuous mapping of the group G onto a circle leads to a topologically equivalent definition of the argument. One single requirement is that the mapping be devoid of coverings. Different definitions of the arguments are given. Each definition leads to a certain new interpretation of the number of stability and instability regions for a system of linear canonical differential equations. Author

N73-20638*# Structures Research Associates, Laguna Beach, Calif.
FEASIBILITY STUDY OF THE NUMERICAL INTEGRATION OF SHELL EQUATIONS USING THE FIELD METHOD
Gerald A. Cohen Apr. 1973 32 p refs
(Contract NAS1-11348)
(NASA-CR-112270) Avail: NTIS HC $3.75 CSCL 12A

The field method is developed for arbitrary open branch domains subjected to general linear boundary conditions. Although closed branches are within the scope of the method, they are not treated here. The numerical feasibility of the method has been demonstrated by implementing it in a computer program for the linear static analysis of open branch shells of revolution under asymmetric loads. For such problems the field method eliminates the well-known numerical problem of long subintervals associated with the rapid growth of extraneous solutions. Also, the method appears to execute significantly faster than other numerical integration methods. Author

N73-20639*# Kanner (Leo) Associates, Redwood City, Calif.
STRUCTURE OF THE GROUP OF SYMPLECTIC MATRICES AND THE STRUCTURE OF THE SET OF UNSTABLE CANONICAL SYSTEMS WITH PERIODIC COEFFICIENTS
V. A. Yakubovich Washington NASA Feb. 1973 55 p refs Transl. into ENGLISH from Mat. Sb. (Moscow), v. 44, (86), no. 3, 1958 p 313-352
(Contract NASw-2481)
(NASA-TT-F-14810) Avail: NTIS HC $4.75 CSCL 12A

Necessary and sufficient conditions for the stability and instability of the solutions of a system of 2K linear differential equations with periodic coefficients in canonical form are derived. These coefficients are functions of certain structural parameters which must be selected in such a way that the solutions satisfy certain bounds. The study is a generalization to higher order systems for the case of a two-equation system. The instability and stability criteria are obtained by examining the structure of the coefficient matrix of the set of all unstable systems and the set of all systems whose solutions satisfy certain bounds. Author

N73-20640*# Kanner (Leo) Associates, Redwood City, Calif.
TECHNICAL STABILITY OF COMPLEX SYSTEMS
A. A. Martynyuk Washington NASA Apr. 1973 18 p refs Transl. into ENGLISH from Kibernetika i Vychislit. Tekh. (USSR), no. 15, 1972 p 58-64
(Contract NASw-2481)
(NASA-TT-F-14869) Avail: NTIS HC $3.00 CSCL 12A

The concept of a locally large Lyapunov function is defined and the function is applied in an analysis of the finite stability of a complex system in a limited range of parameters. It is shown that a complex system has the same order of stability as its subsystems if the subsystems are weakly coupled and are technically stable in terms of compression. Criteria of technical stability are derived for complex systems consisting of subsystems which satisfy the Routh-Hurwitz conditions in the first approximation. Author

N73-20641# National Range Operations Directorate, White Sands Missile Range, N.Mex. Analysis and Computation Div.
OPTIMAL ESTIMATION OF MEASUREMENT BIAS
William S. Agee and Robert H. Turner Dec. 1972 41 p refs
(AD-753961; ACD-41) Avail: NTIS CSCL 12/1

A method is described for the optimal estimation of measurement biases in a Kalman filtering application. The method, which was originally developed by B. Friedland, is based on the decoupling of a large Kalman filter into two smaller filters. One of the smaller filters produces a state estimate which assumes that all measurement biases are zero and the other called the bias filter estimates the measurement biases. The outputs of the two smaller filters are recombined to form the optimal state estimates. Restrictions on the form of the filters which are imposed by the decoupling are discussed. Several extensions of Friedland's original method are presented. Finally, the implementation of the filters via square root filtering techniques is developed. Author (GRA)

N73-20642# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
A SIMPLE COMPUTER PROGRAM FOR SOLVING THE ABEL INTEGRAL EQUATION

A. M. Hunter, II and P. W. Schreiber Aug. 1972 34 p refs
(AD-754003; ARL-72-0106; CPG-730040) Avail: NTIS CSCL 12/1

The objective of this analytical study is to provide a simple computer program to reduce externally measured optical data from axi-symmetric sources to internal state distributions. This is achieved by using MIMIC program language to write a short, easily applied program to perform the Abel inversion. Clear and complete instructions are given so that any person may use the program to reduce experimentally determined lateral profiles to radial internal distributions. Author (GRA)

N73-20643# Illinois Univ., Urbana. Coordinated Science Lab.
A PROBABILISTIC APPROACH TO TRAJECTORY SENSITIVITY Ph.D. Thesis
Yves Raymond Jean-Babtiste Hontoir Nov. 1972 112 p refs
(Contracts DAAB07-67-C-0199; DAAB07-72-C-0259; Grant AF-AFOSR-1579-68)
(AD-754919; R-593; UILU-ENG-72-2255; AFOSR-73-0074TR) Avail: NTIS CSCL 12/1

Trajectory sensitivity is concerned with the investigation of the perturbations in trajectory of dynamical systems induced by small variations in initial conditions and parameters. Existing trajectory sensitivity methods of analysis and synthesis follow a deterministic approach. In cases of practical interest however, for instance in mass-produced control systems or in systems operating in a highly repetitive mode under variable conditions, a probabilistic approach is more appropriate to provide a comprehensive view of trajectory dispersion due to an a priori known distribution of initial conditions and plant parameters. Such a probabilistic approach is developed in this work. Author (GRA)

N73-20644# Army Materiel Systems Analysis Agency, Aberdeen Proving Ground, Md.
ESTIMATION OF A CONVEX COMBINATION OF PROPORTIONS
Larry H. Crow Apr. 1972 45 p refs
(AD-754577; AMSAA-TR-56) Avail: NTIS CSCL 12/1

The report discusses three sampling procedures available for estimating convex combinations of proportions and illustrates the feasibility and practical usefulness of these procedures. The first procedure is an analogue to simple random sampling from a single population. The remaining two procedures are infinite population analogues to optimum and proportional sampling from a single finite population. The practical aspects of selecting a procedure are discussed and numerical examples are given. Author (GRA)

N73-20645# Iowa Univ., Iowa City. Dept. of Mathematics.
RIGHT CONGRUENCES AND SEMISIMPLICITY FOR REES MATRIX SEMIGROUPS
Robert H. Oehmke Dec. 1972 37 p refs
(Contract N00014-68-A-0500)
(AD-754816; TR-58) Avail: NTIS CSCL 12/1

In the paper a comparison is made for various definitions of radicals and semisimplicity on the class of Rees matrix semigroups. Preliminary to this, results are obtained on various types of right congruences. This is equivalent to characterizing various types of automata having a Rees matrix semigroup as an input semigroup. Author (GRA)

N73-20646# Alabama Univ., Huntsville. Research Inst.
CONVERGENCE, ACCURACY, AND STABILITY OF FINITE-ELEMENT APPROXIMATIONS OF A CLASS OF NONLINEAR HYPERBOLIC EQUATIONS
J. T. Oden and R. B. Fost Aug. 1972 24 p refs
(Contract F44620-69-C-0124; AF Proj. 9560; Proj. Themis)
(AD-754948; UARI-RR-129; AFOSR-73-0020TR) Avail: NTIS CSCL 20/11

Numerical stability criteria and rates of convergence are derived for finite-element approximations of the nonlinear wave equation (u sub tt) - F (u sub x) = f(x,t), where F (u sub x) possesses properties generally encountered in nonlinear elasticity. Piecewise linear finite-element approximations in x and central difference approximations in t are studied. Author (GRA)

N73-20647# Naval Underwater Systems Center, Newport, R.I. Computer Lab.
SOME SOLUTIONS OF WAVE EQUATIONS: EXAMPLES AND TECHNIQUES
David H. Wood 4 Oct. 1972 84 p refs
(AD-754793; NUSC-TR-4415) Avail: NTIS CSCL 12/1

Series solutions are found for the reduced wave equation characterizing radiation from a point source in two and three dimensions. The applicability of the conformal mapping principle is considered and it is found that reduced wave equations are sometimes related by a change of independent variables which is necessarily given by a conformal mapping. It is shown that by disregarding one exceptional case and linear changes of variables, a general elliptic partial differential equation in two variables can be tranformed into at most one equation in canonical form whose coefficients depend on only one variable. Author

N73-20648# Montclair State Coll., Upper Montclair, N.J.
AN ANALYSIS OF EXTREME HAMILTONIAN CIRCUITS
Kenneth Kalmanson 31 Oct. 1972 28 tp refs
(Contract N00014-72-C-0436; NR Proj. 047-109)
(AD-754842; TR-1) Avail: NTIS CSCL 12/2

The report investigates the problem of finding the shortest and longest Hamiltonian circuits on a complete graph, having finitely many vertices. Analytic conditions, involving sets of inequalities between edge lengths - which the authors call edgeconvexity - are given which lead to minimal and maximal circuits. Geometric realizations of this condition are given, which include convex polygons in the Euclidean plane and on the two-sphere. Other realizations include convex polygons in the plane where distance is measured with any linear (Minkowski) metric; points on rectifiable Jordan curve, where distance is measured by minor arc length; points in a Minkowski plane, distance measured with the Minkowski metric, where there is a minimal Hamiltonian circuit (H-circuit) whose length equals that of the perimeter of the convex hull of the set of points. Author (GRA)

N73-20649# Brown Univ., Providence, R.I. Center for Dynamical Systems.
VERSATILE METHODS FOR THE SEQUENTIAL MONTE CARLO OPTIMIZATION OF UNCONSTRAINED STOCHASTIC SYSTEMS
Harold J. Kushner and T. Gavin Nov. 1972 26 p refs
(Contract N00014-67-A-0191-0018; Grants AF-AFOSR-2078-71; NSF GK-31073X; NR Proj. 041-411)
(AD-754413; CDS-TR-72-5) Avail: NTIS CSCL 12/1

The paper discusses a versatile family of Monte Carlo methods for the sequential optimization of stochastic systems. The method selects a sequence of successive one-dimensional search directions, defines a (stochastic) search in each of the directions, where the data used for both the one-dimensional search and the direction determination are merely noise-corrupted observations on the system. The method is more general than stochastic approximation, it converges to a stationary point even in the presence of multiple minima, and it uses rather natural logics. A convergence theorem is proved. Author (GRA)

N73-20650# Naval Postgraduate School, Monterey, Calif.
OPTIMAL CONTROL OF SYSTEMS GOVERNED BY DELAYED DIFFERENTIAL EQUATIONS
Joseph G. Hyde and Ronald A. Hess Dec. 1972 58 p refs
(AD-754379; NPS-57HE72121A) Avail: NTIS CSCL 12/1

Optimal control of systems governed by delayed-differential equations is explored by using the control theory developed for systems governed by ordinary differential equations. A simple algorithm for producing a suboptimal control law with restricted feedback is presented. Two examples illustrate the computational method. Author (GRA)

N73-20685 Officine Galileo S.p.A., Florence (Italy).
STRAPPED DOWN INERTIAL GUIDANCE SYSTEM STUDY
R. Baldassini Fontana *In* AGARD Inertial Navigation Components and Systems Feb. 1973 42 p refs (For availability see N73-20684 11-21)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N73-20651 National Lending Library for Science and Technology, Boston Spa (England).

ON THE RELATIONSHIP BETWEEN SOLAR ACTIVITY AND PRESSURE FIELD OF THE NORTHERN HEMISPHERE OF THE EARTH

I. V. Maksimov and B. A. Slepcov-Sevlevic [1972] 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), no. 201, 1971 p 339-341

(NLL-M-22858-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The annual atmospheric mean pressures in the Northern Hemisphere from 1901 to 1967, corresponding to six 11-year cycles to solar activity were studied by drawing charts of the geographical distribution of the atmospheric pressures for every year. It is concluded: (1) The planetary solar pressure wave is a stationary pressure wave near 40 N, (2) The maximum pressures occur in Greenland, and Alaska, (3) The existence of a 22-year solar cycle is a valid view. F.O.S.

N73-20652 National Lending Library for Science and Technology, Boston Spa (England).

INFLUENCE ON VOLCANIC ERUPTION EXERTED BY PARTICULAR WEATHER AND CLIMATIC SITUATIONS

Moriya Shimada [1972] 15 p refs Transl. into ENGLISH from Kishoch Kenkyu Jiho (Tokyo), v. 23, 1971 p 1-8

(NLL-M-22864-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A causal relation is proposed by giving examples of the correspondence between principle volcanic eruptions and principle climatic variations. The principle climatic variations include atmospheric pressure fluctuations and anomalous weather histories. It is concluded that volcanic activity and anomolous weather are simultaneous phenomena; both being results. The cause is an anomaly in atmospheric circulation which produces an anomolous high or low pressure. D.L.G.

N73-20653 National Lending Library for Science and Technology, Boston Spa (England).

SYNOPTIC - CLIMATOLOGICAL METHOD FOR FORECASTING AMOUNTS OF RAIN OF 30 mm OR MORE IN A DAY

L. J. Jakovleva [1972] 7 p refs Transl. into ENGLISH from Tr. Vyp. Nauch.-Issled. (USSR), v. 76, 1971 p 116-121

(NLL-M-22865-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Long term forecasts of heavy rain for the northwestern districts of the European U.S.S.R. were studied. A climatological analysis of heavy rain (for days with an amount of 30 mm or more) observed in these districts, from 1951 to 1966, indicate that 78% of the heavy rain fell in the summer. Using a synoptic-climatological forecasts for 2 summers, heavy rain was expected during 20 periods. Rain was actually observed 15 periods (verification of rainfall forecasts was 75%). F.O.S.

N73-20654 National Lending Library for Science and Technology, Boston Spa (England).

THE GENERAL PROBLEM OF THE OPTIMUM INTERPOLATION AND EXTRAPOLATION OF METEOROLOGICAL FIELDS

L. S. Gandin [1972] 12 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), v. 168, 1965 p 75-83

(NLL-M-22856-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Equations are derived for the optimum interpolation and extrapolation of meteorological fields for general cases. A series of schemes is examined for the description of correlation functions which assure positive definiteness of the interpolated systems, and reasonable results for interpolation and extrapolation.

Author

N73-20655 National Lending Library for Science and Technology, Boston Spa (England).

FORECASTING OF MONTHLY MEAN AIR TEMPERATURE ANOMALIES BY ANALOGUES

K. A. Vasjukov, N. I. Zverev, and L. M. Zinoveva [1972] 8 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchn.-Issled. Tsentr. SSSR (Leningrad), v. 80, 1971 p 28-34

(NLL-M-22859-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Analogs selected from air temperature and pressure anomalies at sea level, and the circulation of air at the mean level of the troposphere were studied for forecasting monthly mean temperature. Using the criteria of analogy, analog years were selected, and anomaly forecasts of the monthly temperature means were prepared. It is concluded that the analog forecasts are satisfactory and the analogs can be used to predict the distribution of positive and negative centers. F.O.S.

N73-20656 National Lending Library for Science and Technology, Boston Spa (England).

METHODS OF DETERMINING THE ELECTRICALLY DANGEROUS ZONES IN NIMBO-STRATUS

V. S. Aleksandrov et al [1972] 16 p refs Transl. into ENGLISH from Gidromet. Inst., Proc. All Union Conf. Problems Met. Safety Supersonic Aviat., 24-26 Mar. 1971 (Leningrad), 1971 p 313-323

(NLL-M-22800-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The probability of an aircraft being struck by lightning in thunderstorms was investigated. Conditions for the production of lightning in clouds are discussed along with the conditions in which aircraft are struck by lightning. It is concluded that in clouds with high water content, there is a marked increase in the probability of encountering large charges on an aircraft, and that most instances of aircraft being struck by lightning occur between +5 and -15 C. F.O.S.

N73-20657 National Lending Library for Science and Technology, Boston Spa (England).

PROBLEMS IN THE STATISTICAL CHOICE OF PREDICTORS IN LONG RANGE FORECASTING

V. G. Blazhevich [1972] 8 p Transl. into ENGLISH from Gidromet. Nauc. Issled. Cent. SSSR, Proc. All-Union Conf. Young Scientists, USSR Hydromet. Serv. (Weather Anal. Forecast) (Leningrad), 1971 p 75-82

(NLL-M-22803-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The selection of statistically significant relationships for predictors was studied to lessen the possibility of using false statistical relationships in long range weather forecasts. The instability of the forecasting relationships with time, and its influence on the accuracy of statistical forecasts are discussed along with allowance for the nonlinearity of correlations for eliminating false relationships, which was achieved in practice by examining correlation graphs. Examples of the application of the coefficients of expansion into natural orthogonal functions are included. F.O.S.

N73-20658*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A REVIEW OF METHODS FOR PREDICTING AIR POLLUTION DISPERSION

Joe J. Mathis, Jr. and William L. Grose Washington 1973 46 p refs

(NASA-SP-322; LC-73-600023) Avail: NTIS HC $3.00 CSCL 04B

Air pollution modeling, and problem areas in air pollution dispersion modeling were surveyed. Emission source inventory, meteorological data, and turbulent diffusion are discussed in terms of developing a dispersion model. Existing mathematical models of urban air pollution, and highway and airport models are discussed along with their limitations. Recommendations for improving modeling capabilities are included. F.O.S.

N73-20659# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.

CONTROL TECHNIQUES FOR BERYLLIUM AIR POLLUTANTS

J. F. Peoples, Jr., J. A. Desantis, and J. U. Crowder Feb. 1973

24 p refs
(AP-116) Avail: SOD HC $0.95 domestic postpaid or $1.75 GPO Bookstore

Beryllium extraction processes generate atmospheric emissions that include beryllium salts, acids, beryllium oxide, and other beryllium compounds in the form of dust, fume, or mist. Facilities engaged in processing beryllium-containing materials into finished products generate a more restricted range of emissions, including beryllium dust from machine shops, beryllium oxide dust from ceramic production, and beryllium-containing dust and fume from beryllium-copper foundry operations. Beryllium emissions can be controlled by the following classes of gas-cleaning equipment: prefilters, dry mechanical collectors, wet collectors, fabric filters, and high-efficiency particulate air filters (HEPA filters). In most cases, emission control costs, including capital investment, operating and maintenance costs, and capital charges, do not exceed 10 to 15 percent of the cost of manufacturing equipment. Beryllium-contaminated waste can be buried at controlled disposal sites unless it presents an explosion hazard. Beryllium propellant and other hazardous beryllium-contaminated wastes can be disposed of by controlled incineration of detonation employing appropriate emission control devices.
Author

N73-20660# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
CONTROL TECHNIQUES FOR ASBESTOS AIR POLLUTANTS
J. U. Crowder and G. H. Wood Feb. 1973 103 p refs
(AP-117) Avail: SOD HC $2.10 domestic postpaid or $1.75 GPO Bookstore

Adverse effects of airborne asbestos on human health have been associated primarily with direct and indirect occupational exposures. Engineering appraisals, based on limited data, indicate that the milling and basic processing of asbestos ore and the manufacture of asbestos-containing friction materials, asbestos-cement products, vinyl-asbestos tile, asbestos textiles, and asbestos paper account for over 85 percent of total asbestos emissions. Emissions are controlled in several ways: (1) by careful handling of dry materials to avoid generating dust; (2) by enclosing dusty operations; (3) by substituting wet processes for dry processes; (4) by wetting dry materials before handling sawing, or grinding; (5) by cleaning the dust-laden air by drawing it into ducts that lead to fabric filters; and (6) by reducing the amount of asbestos added to products the use of which leads to the generation of emissions. The last technique is particularly applicable to situations where the control of emissions by other methods is very difficult, as with spray application of insulation or demolition of structures. The costs of needed emission control techniques can be estimated from those associated with existing practices.
Author

N73-20661# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
CONTROL TECHNIQUES FOR MERCURY EMISSIONS FROM EXTRACTION AND CHLOR-ALKALI PLANTS
S. L. Roy, Jr., G. S. Thompson, Jr., F. M. Alpiser, and T. R. Osag Feb. 1973 74 p refs
(AP-118) Avail: SOD HC $0.95 domestic postpaid or $0.70 GPO Bookstore

An effort is made to identify the process steps that may produce atmospheric mercury emissions, to summarize the emission control techniques and low mercury emission processes used or applicable to these industries, and to evaluate these techniques in terms of cost and effectiveness. The condenser gas stream is the major source of mercury emissions from a primary mercury processing plant. Mercury emissions can be reduced by the installation of control systems and the use of good housekeeping practices. The hydrogen gas and the end-box ventilation air streams can be treated by cooling and mist elimination, chemical scrubbing, or adsorption beds. A control system for a primary mercury facility using cooling and mist elimination would cost between $86,000 and $108,000, depending upon the type of mist elimination device used. The cost of a similar control system for a chlor-alkali plant is estimated at $202,000. The cost of a carbon bed adsorption system for a primary mercury facility is estimated at $66,000. Author

N73-20662# Federal Aviation Administration, Washington, D.C.
ENGINEERING AND DEVELOPMENT PROGRAM PLAN: WEATHER
Feb. 1973 61 p
(FAA-ED-15-1) Avail: NTIS HC $5.25

The FAA research and development activities relating to aviation weather are discussed. The plan has been structured with the primary purpose of providing tailored weather information for use by pilots and air traffic controllers. There are two program subdivisions (program elements) in the plan: (1) weather data acquisition, generally involving the development of measurement techniques and hardware devices to be used in gathering precise weather data; and (2) weather data processing and distribution, concerned primarily with converting raw weather data into meaningful information and disseminating this information to pilots and air traffic controllers. The plan describes progress and accomplishments, current objectives, prospects for products and funding data for the projects involved.
Author

N73-20663# National Meteorological Center, Washington, D.C.
TOWARD DEVELOPING A QUALITY CONTROL SYSTEM FOR RAWINSONDE REPORTS
Frederick G. Finger and Arthur R. Thomas Feb. 1973 34 p refs
(NOAA-TM-NWS-NMC-52) Avail: NTIS HC $3.75

Many of the problems that prevent rawinsonde data from reaching the user can be rectified by proper quality control procedures. Methods have been developed to test the effectiveness of quality control, and these have resulted in significant improvements in data usage. An effective program to adequately control data quality involves integrated functions at data sources, communications centers, processing centers, and headquarters elements.
Author

N73-20664# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 14802 LANCE, MISSILE NOS. 2184 AND 2188 (17 NOVEMBER 1972) Meteorological Data Report
Nov. 1972 40 p
(DA Proj. 1T6-65702-D-127)
(AD-754555; DR-744) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 14802 Lance, Missile Numbers 2184 and 2188, are presented in tabular form.
Author (GRA)

N73-20665# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 15001 LITTLE JOHN, MISSILE NO. 1508, ROUND NO. 697 RG (10 NOVEMBER 1972) Meteorological Data Report
Nov. 1972 23 p
(DA Proj. 1T6-65702-D-127)
(AD-754558; DR-739) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 15001 Little John, Missile Number 1508, Round Number 697 RG, are presented in tabular form.
Author (GRA)

N73-20666# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 11601 LANCE, MISSILE NO. 2353, ROUND NO. 170 APT (14 NOVEMBER 1972) Meteorological Data Report
Nov. 1972 43 p
(DA Proj. 1T6-65702-D-127)
(AD-754554; DR-741) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 11601 Lance, Missile Number 2353, Round Number 170 APT, are presented in tabular form.
Author (GRA)

N73-20667# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
ATHENA H-007, FLIGHT 135 (26 OCTOBER 1972) Meteorological Data Report
John M. Sharpe Oct. 1972 59 p refs
(DA Proj. 1T6-65702-D-127)
(AD-754557; DR-735) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of Athena Flight 135, Vehicle H-007, are presented for the Air Force Space and Missile Systems Organization and for ballistic studies. The data are presented in tabular and figure form.
Author (GRA)

N73-20668# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS. JAPANESE AND KOREAN COASTAL MARINE AREAS. VOLUME 2: AREA 4, TOKYO; AREA 5, HACHIJO JIMA; AREA 6, NAGOYA
May 1972 486 p
(AD-754773) Avail: NTIS CSCL 04/2

The data contained in these tables were obtained from Tape Data Family 11 (TDF-11) Marine Surface Observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of Coastal Marine Summaries. Author (GRA)

N73-20669# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 14801 LANCE, MISSILE NO. 2184, ROUND NO. 168 APT (9 NOVEMBER 1972) Meteorological Data Report
Nov. 1972 34 p
(DA Proj. 1T6-65702-D-127)
(AD-754556; DR-738) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 14801 Lance, Missile Number 2184, Round Number 168 APT, are presented in tabular form. Author (GRA)

N73-20670# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A LONG-RANGE FORECAST BY MEANS OF SPECTRAL NONLINEAR BAROCLINIC MODEL OF THE ATMOSPHERE
I. G. Veil 12 Jan. 1973 44 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchn.-Issled. Tsentr SSSR (USSR), no. 71, 1970 p 24-58
(AD-754682; FTD-MT-24-1161-72) Avail: NTIS CSCL 04/2

A baroclinic model is proposed for computing the stream function. It is based on the spectral method for solving nonlinear eddy equations and the first principle of thermodynamics, written in an adiabatic approximation. The solution is sought for a hemisphere. The stream function is assumed to be antisymmetric relative to the equator. The problem is reduced to solution of systems of ordinary differential equations for the expansion coefficients. The solution is obtained in time steps using the Adams method. Author (GRA)

N73-20671# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 13801 LITTLE JOHN, MISSILE NOS. 3202/3134, ROUND NOS. 688/689 RO, 14 SEPTEMBER 1972 Meteorological Data Report
Sep. 1972 26 p
(DA Proj. 1T6-65702-D-127)
(AD-754561; DR-747) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 13801 Little John, Missile Numbers 3203/3134, Round Numbers 688/689 RO, are presented in tabular form. Author (GRA)

N73-20672# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 11607 LANCE, MISSILE NO. 2147, ROUND NO. 175 RCT Meteorological Data Report
6 Dec. 1972 21 p
(DA Proj. 1T6-65702-D-127)
(AD-754565; DR-748) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 11607 Lance, Missile Number 2147, Round Number 175 RCT, are presented in tabular form. Author (GRA)

N73-20673# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 12807 LANCE, MISSILE NO. 2177, ROUND NO. 171, 17 NOVEMBER 1972 Meteorological Data Report
Nov. 1972 39 p
(DA Proj. 1T6-65702-D-127)
(AD-754564; DR-743) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 12807 Lance, Missile Number 2177, Round Number 171, are presented in tabular form. Author (GRA)

N73-20674# California Univ., Berkeley. Operations Research Center.
AVERAGING TIME AND MAXIMA FOR DEPENDENT OBSERVATIONS
Richard E. Barlow and Nozer D. Singpurwalla Dec. 1972 34 p refs Prepared in cooperation with George Washington Univ., Washington, D. C.
(Contracts N00014-69-A-0200-1036; N00014-67-A-0214; Grants NSF GP-29123; NSF GU-3287; NR Proj. 042-238; NR Proj. 347-020)
(AD-754788; ORC-72-31) Avail: NTIS CSCL 13/2

For the purposes of evaluating air quality, it is important to know the probability that maximum pollutant concentrations will exceed state standards stated for various averaging times. In the paper, the authors present a new approach for analyzing certain time series processes. They show that, under certain conditions, several stochastic processes which could generate a time series for air pollutant data are associated. Association is a strengthening of the concept of positive correlation. The processes that are considered here are the autoregressive, the Markov, and a stationary Gaussian process with a specified autocorrelation function. The extreme value distribution is shown to provide a lower bound on the distribution function of the maxima of averages of observations generated by an associated stochastic process. GRA

N73-20675# Ultrasystems, Inc., Irvine, Calif.
HEAT PRODUCTION FOR AIR FORCE FOG DISSIPATION PROGRAM Final Report, 15 Apr. 1971 - 27 Oct. 1972
Frank C. Price 27 Oct. 1972 57 p
(Contract F19628-71-C-0139; AF Proj. 7605)
(AD-754900; SN-246; AFCRL-72-0626) Avail: NTIS CSCL 04/2

A heating system was supplied and operated to support an AFCRL test program of warm fog dispersal. The system consisted of four parallel rows of liquid propane burners and associated tanks, pumps, and fuel lines. The maximum heat release was 600 million Btu/hr which was adequate to clear fog along a 400-ft width, 200 ft high in 10 mph winds of 40 degrees range in direction. A total of 191 tests were run: 63 with fog and 128 with clear air. This report describes the system and presents a log of the heating rates and burner arrangements which were operated for the tests conducted by AFCRL. Author (GRA)

N73-20676# Naval Postgraduate School, Monterey, Calif.
INTENSITY CHANGES OF TROPICAL CYCLONES IN THE WESTERN NORTH PACIFIC OCEAN DURING 1960 - 1969 M.S. Thesis
Kenneth Raymond Liechty Sep. 1972 137 p refs
(AD-754349) Avail: NTIS CSCL 04/2

Six-hourly observations containing 18 parameters of tropical storms and typhoons in the western North Pacific Ocean during the period 1960 through 1969 were examined. The data were composited into four periods, before and after maximum intensity for east-west moving storms, and before and after recurvature for recurving storms. Monthly and seasonal variations of tropical cyclone intensity, speed of movement and size were examined. Correlation coefficients of the 18 tropical storm and typhoon parameters were computed for each of the four composited periods of study. Author (GRA)

N73-20677# Naval Postgraduate School, Monterey, Calif.
AIR-SEA OBSERVED SURFACE TEMPERATURES AND THEIR DISTRIBUTION IN HURRICANES, GULF OF MEXICO M.S. Thesis
Robert Woodrow Lyons Sep. 1972 72 p refs
(AD-754353) Avail: NTIS CSCL 04/2

Observed near-surface air and sea-surface temperatures for three hurricanes Hilda (1964), Betsy (1965) and Camille (1969) were studied. Composites were made for each of the storms. These composites were oriented to true north, had diameters of 400 n mi and covered the period in the Gulf of Mexico prior to the time the hurricanes reached maximum intensity. The mean air temperature was less than the mean sea-surface temperature, and this difference varied from 1.2C in the outer region of the composites to 2.9C near the center. In the 24-hour period prior to maximum hurricane intensity, the

difference was 4.3C near the center. The data also indicated that the distribution of air-sea temperature difference within the hurricanes varied by quadrant with the southeast quadrant containing the largest over-all average difference (2.4C) and the southwest quadrant averaging 1.1C. Author (GRA)

N73-20678# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 12802 LANCE, MISSILE NO. 2150, ROUND NO. 174 ESL, 1 DECEMBER 1972 Meteorological Data Report
Dec. 1972 55 p
(DA Proj. 1T6-65702-D-127)
(AD-754563; DR-746) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 12802 Lance, Missile Number 2150, Round Number 174 ESL, are presented in tabular form. Author (GRA)

N73-20679# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 14101 LITTLE JOHN RIP, MISSILE NO. 515, ROUND NO. 2, 16 NOVEMBER 1972
Nov. 1972 16 p
(DA Proj. 1T6-65702-D-127)
(AD-754560; DR-742) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 14101 Little John RIP, Missile Number 515, Round Number 2, are presented in tabular form. Author (GRA)

N73-20680# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 14802 LANCE MISSILE NO. 2186, ROUND NO. 169 APL Meteorological Data Report
Nov. 1972 49 p
(DA Proj. 1T6-65702-D-127)
(AD-754559; DR-740) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 14802 Lance, Missile Number 2186, Round Number 169 APL, are presented in tabular form. Author (GRA)

N73-20681# Motorola, Inc., Scottsdale, Ariz. Government Electronics Div.
AMSS PROTOTYPE ROCKETSONDE AND GROUND ANTENNA DEVELOPMENT Final Report, 14 Apr. 1969 - 15 Nov. 1971
Warren M. Griggs, James A. Higgs, and J. Kenneth Wood 31 Dec. 1971 122 p refs
(Contract F19628-69-C-0223; AF Proj. 6670; AF Proj. 7659)
(AD-754895; FR-3734; AFCRL-72-0106) Avail: NTIS CSCL 04/2

The report summarizes the most recent development efforts for the Advanced Meteorological Sounding System (AMSS). The system design provides for automatic ranging and accurate telemetry of four meteorological data channels to 200 km altitudes by means of rocket-borne transponder type sondes and to 46 km by balloon-borne sondes, with a maximum slant range of 300 km (187 miles). Meteorological data is obtained from sensors attached to the radiosonde and positional information is determined from slant range measurement and the ground tracking antenna. Unambiguous slant range to 600 km is obtained from ground transmission and reception times of a pseudo random noise (PRN) code. Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N73-20682*# Analytic Sciences Corp., Reading, Mass.
DYNAMIC ERRORS IN A TUNED FLEXURE-MOUNTED STRAPDOWN GYRO Interim Scientific Report, Jan. - Jul. 1972
John E. Bortz, Sr. Sep. 1972 62 p refs
(Contract NAS12-678)
(NASA-CR-124161; TR-147-5) Avail: NTIS HC $5.25 CSCL 17G

Motion induced errors in a tuned, flexure-mounted strapdown gyro are investigated. Analytic expressions are developed for errors induced by linear vibrations, angular motion, and detuning. Sensor-level errors (gyro drift rate) and system-level errors (navigation errors) that are stimulated by an actual dynamic motion environment are computed. Author

N73-20683*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
SPIN REORIENTATION OF A NONSYMMETRIC BODY WITH ENERGY DISSIPATION
Robert J. Cenker [1973] 55 p refs
(Grant NGR-39-009-162)
(NASA-CR-131320; Astronaut-RR-73-2) Avail: NTIS HC $4.75 CSCL 22A

Stable rotating semi-rigid bodies were demonstrated analytically, and verified in flights such as Explorer 1 and ATS-5 satellites. The problem arises from the two potential orientations which the final spin vector can take after large angle reorientation from minor to major axis, i.e., along the positive or negative axis of the maximum inertia. Reorientation of a satellite initially spinning about the minor axis using an energy dissipation device may require that the final spin orientation be controlled. Examples of possible applications are the Apogee Motor Assembly with Paired Satellites (AMAPS) configuration, where proper orientation of the thruster is required; and reorientation of ATS-5, where the spin sensitive nature of the despin device (yo-yo mechanism) requires that the final spin vector point is a specified direction. Author

N73-20684# Advisory Group for Aerospace Research and Development, Paris (France).
INERTIAL NAVIGATION COMPONENTS AND SYSTEM
Feb. 1973 402 p refs In ENGLISH; partly in FRENCH Presented at the 15th Meeting of the Guidance and Control Panel of AGARD, Florence, 2-5 Oct. 1972
(AGARD-CP-116) Avail: NTIS HC $22.25

The proceedings of a conference on inertial navigation components and systems are presented. The objective of the meeting was to provide current information of inertial navigation developments and to discuss applications and test results. Emphasis was placed on concepts and techniques which show the trade-offs dealing with cost versus performance. The subjects discussed include: (1) strapped down inertial guidance systems, (2) inertial navigation systems for the space shuttle, (3) materials for the inertial navigation systems, (4) gyro stabilized platform applications, (5) inertial system for missile midcourse guidance, and (6) fault isolation and maintenance concepts for inertial navigation systems. For individual titles, see N73-20685 through N73-20717.

N73-20685 Officine Galileo S.p.A., Florence (Italy).
STRAPPED DOWN INERTIAL GUIDANCE SYSTEM STUDY
R. Baldassini Fontana *In* AGARD Inertial Navigation Components and Systems Feb. 1973 42 p refs (For availability see N73-20684 11-21)

The sources and magnitudes of errors occurring in a strapped down environment are discussed. The functions of the accelerometers and gyroscopes in a strapped down system are described. The parameters which must be investigated and defined to evaluate the performance of a stabilized platform are tabulated. The requirements of inertial sensors for maintaining vehicle attitude, velocity, and position are examined. Mathematical models for determining the errors produced by various parameters which affect the inertial system are developed. Diagrams of typical strapdown systems are included. P.N.F.

N73-20686 Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
SUMMARY OF NEW DEVELOPMENTS AT THE DRAPER LABORATORY
Robert A. Duffy *In* AGARD Inertial Navigation Components and Systems Feb. 1973 5 p (For availability see N73-20684 11-21)

Research projects involving the development of inertial guidance systems and components are discussed. The application of inertial guidance to tactical and strategic missile systems is analyzed. The efforts of the laboratory in support of the Apollo

project are examined. Fault tolerant design concepts in digital computer construction are advocated as a means of achieving improved reliability. Systems for stabilizing Orbital Astronomical Observatory satellites are reported. Specific systems for lunar exploration, commercial air transportation, oceanography, flight control, and biomedical experiments are briefly discussed. P.N.F.

N73-20687* Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.

FAILURE MANAGEMENT OF MULTIPLE GIMBAL INERTIAL SYSTEMS FOR SPACE SHUTTLE

David W. Dove and Richard A. McKern *In* AGARD Inertial Navigation Components and Systems Feb. 1973 14 p refs Sponsored by NASA (For availability see N73-20684 11-21) CSCL 17G

A failure detection and isolation technique for use with four gimbaled inertial measurement units (IMU) is presented. By using simulated boost and entry shuttle trajectories with specific gimbaled IMU models, failure detection thresholds are developed based on red-line life dependent requirements and warning thresholds within the red-line thresholds based on expected worst case IMU performance. Using these trajectories, established trajectory threshold, and multiple IMU models, various failure detection and isolation techniques are evaluated for application in both powered and unpowered flight phases. The adequacy of the systems for both attitude and velocity detection methods is evaluated and recommendations for space shuttle applications are made. Author

N73-20688 Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.

STRAPDOWN INERTIAL GYROSCOPE

Michele S. Sapuppo *In* AGARD Inertial Navigation Components and Systems Feb. 1973 10 p refs (For availability see N73-20684 11-21)

A miniature single-degree-of-freedom gyroscope has been developed for the application to a strapdown inertial guidance system. This development is based on many years of experience with the design and development of high-performance pendulous integrating gyroscopic accelerometers (PIGA). By utilizing basic design principles of the gyroscopic element contained in the PIGA, which by nature of the PIGA operation presents a slew environment to the gyroscopic element, a strapdown gyroscope evolves which operates and performs exceptionally well under high linear accelerations and high slew rates. This paper describes a strapdown gyroscope that is less than 1-1/2 inches in diameter by 2 inches in length and weighing under 1/2 pound. The angular momentum is only 8.5 X 1,000 dyne-cm-sec, which gives it several natural benefits of small size, low power consumption, high reliability, and reasonable cost. To achieve high performance with low angular momentum, low uncertainty torques are required about the output axis of the gyroscope. The design of this strapdown gyroscope involved the systematic identification of each error source coupled with the introduction of subcomponent design principles to reduce these error magnitudes and therefore minimize the consequential sources of uncertainty torque.

Author

N73-20689 Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.

INERTIAL-GYRO TESTING FOR RELIABILITY

Albert P. Freeman *In* AGARD Inertial Navigation Components and Systems Feb. 1973 10 p (For availability see N73-20684 11-21)

Methods for conducting reliability tests of gyroscopes used with inertial platforms. The types of tests required are defined as: (1) acceptance tests to determine if the gyroscope can meet performance requirements and (2) reliability and/or design verification tests. The acceptance tests are identified to show the parameters which are measured. The design verification tests are concerned with environmental tests, reliability analyses, and engineering evaluation. A typical reliability test specification is included. P.N.F.

N73-20690 Litton Systems, Inc., Woodland Hills, Calif.

P-4, A LOW-COST IMU RESULTING FROM OPTIMUM SIZE DESIGN

John H. Tamura and John M. Peterson *In* AGARD Inertial Navigation Components and Systems Feb. 1973 9 p (For availability see N73-20684 11-21)

The P-4 Inertial Measurement Unit development program was undertaken to achieve a low-cost IMU with navigational accuracy performance resulting from optimum size design of inertial instruments and platform. This approach placed a heavy emphasis on simplification and reduction in the number and complexity of individual parts. The cost-size tradeoff studies which were conducted for the inertial components, gimbal set, and system during the design phase are presented and discussed. The result of the development program is an inertial platform of 2.8 inches in diameter and 3.15 inches in length, weighing 1.9 pounds and requiring 25 watts of power. The resulting Inertial Measurement Unit is contained in a single package 3.5 inches by 3.25 inches by 7.25 inches, weighing 6 pounds. Author

N73-20691 Societe d'Applications Generales d'Electricite et de Mecanique, Paris (France).

METHOD OF MEASURING THE INERTIAL QUALITIES OF A QUASI-SPHERICAL ROTOR [METHODE DE MEASURE DES QUALITES INERTIELLES D'UN ROTOR QUASI SPHERIQUE]

L. Camberlein, A. Deval, and J. C. Silvestre *In* AGARD Inertial Navigation Components and Systems Feb. 1973 9 p refs In FRENCH (For availability see N73-20684 11-21)

A method for measuring inertia that is applicable to spherical gyroscope rotors with electric suspension is analyzed. The method permits the principle axis of inertia relative to the center of mass to be determined and allows the relative differences of inertial moments to be measured. Transl. by E.H.W.

N73-20692 Queen Mary Coll., London (England). Dept. of Materials.

MICROPLASTICITY IN MATERIALS FOR INERTIAL NAVIGATION SYSTEMS c17

William Bonfield *In* AGARD Inertial Navigation Components and Systems Feb. 1973 6 p refs (For availability see N73-20684 11-21)

The determination of the friction stress, the microscopic yield stress (the stress to produce a plastic strain of 2 x 10.000006) and the rate of strain hardening in the microstrain region is described. An evaluation of the influence of some metallurgical variables on these parameters is presented, in which particular reference is made to the characteristics of beryllium, aluminum and a copper-beryllium age hardening alloy. The interpretation of the microstrain results is discussed from two standpoints; first, the development of a general understanding of microplasticity, and, second, the application of such concepts to inertial navigation components. Author

N73-20693 Army Electronics Command, Fort Monmouth, N.J. Avionics Lab.

RAPID INITIALIZATION OF INERTIAL NAVIGATION SYSTEMS THROUGH PARAMETER ESTIMATION

Joseph A. Dasaro *In* AGARD Inertial Navigation Components and Systems Feb. 1973 11 p refs (For availability see N73-20684 11-21)

The problem of rapid initialization of an inertial navigation system using an azimuth wander mechanization is treated in detail. An error model is developed which contains all significant cross-coupling terms and inertial component random drifts. Determination of the initial azimuth wander angle is then identified as a parameter estimation problem where the parameter can assume any of a continuum of values (from 0 to 2 pi). Two methods of solving parameter estimation problems currently in the literature are discussed. One of the methods is then extended to permit time optimal estimation of the initial azimuth angle. The platform controller is developed and the overall system described. Results of a computer simulation are presented.

Author

N73-20694 Teldix Luftfahrt-Ausruestungs G.m.b.H., Heidelberg (West Germany).

INVESTIGATIONS ON THE OPTIMIZATION OF AIDED INERTIAL NAVIGATION SYSTEMS

Rainer S. Sindlinger *In* AGARD Inertial Navigation Components and Systems Feb. 1973 16 p refs (For availability see N73-20684 11-21)

The stringent performance requirements for modern, self-contained aircraft navigation systems can only be met by integrated systems combining several independent navigation sensors, like inertial measurement unit, Doppler radar, and radio position fixing devices (e.g. Tacan). Some investigations on the optimization of such integrated navigation systems are discussed. It will be shown, that high navigation accuracy can be obtained even with medium-performance sensors by implementation of an optimal estimation and control filter, and by the use of methods reducing the influence of some inertial sensor errors on the system performance. The basic rule for the realization of an effective integrated navigation system is to use sensors with complementary characteristics, but with mutually balanced accuracy. Author

N73-20695 Army Missile Command, Redstone Arsenal, Ala. Guidance and Control Directorate.
COMPLIANT SURFACES FOR AIR BEARING GYROS
James V. Johnston *In* AGARD Inertial Navigation Components and Systems Feb. 1973 8 p refs (For availability see N73-20684 11-21)

A development study on a spherical, hydrostatic, compliant bearing for a directional gyro is discussed. The concept of the rubber air bearing and its subsequent development is traced through its analytical analysis and experimental hardware fabrication to the test results. Use of a compliant material for one of the bearing surfaces, which would grip the rigid surface when unpressurized, constitutes the novel concept of self caging. Included in this paper are the basic design curves developed for the compliant bearing. Use of these curves provides the bearing engineer with the basic tools necessary to design compliant air bearings. Unusual problems encountered in the fabrication and evaluation of rubber bearings are shown and discussed. Areas of further investigation are indicated which would enhance the rubber bearing development technologies. Author

N73-20696 CIT Compagnie Industrielle des Telecommunications, Bruyeres-le-Chatel (France). Div. des Essais et des Systemes Inertiels.
GAS HYDRODYNAMIC LANDING GYROSCOPE WITH TWO DEGREES OF FREEDOM: METHOD OF EVALUATING PERFORMANCE [GYROSCOPE A DEUX DEGRES DE LIBERTE SUR PALIER A GAZ HYDRODYNAMIQUE METHODE D'EVALUATION DES PERFORMANCES]
Pierre Leger *In* AGARD Inertial Navigation Components and Systems Feb. 1973 19 p refs In FRENCH (For availability see N73-20684 11-21)

Two principle means developed to measure the functions and performance of a gyroscope with two degrees of freedom are outlined. A mathematical model representing the essential characteristics of the apparatus, given the formulation of parasitic coupling of the gyroscope under constant acceleration, is described. Statistical optimization was used to analyze multi-position effects according to the type of gyroscope and numerous redundancies present in a series of measurements. Probable coefficients of the model and the uncertainties associated with these coefficients are evaluated. Transl. by E.H.W.

N73-20697 Teledyne Systems Co., Northridge, Calif.
DYNAMICALLY TUNED GYROS IN STRAPDOWN SYSTEMS
Robert J. G. Craig *In* AGARD Inertial Navigation Components and Systems Feb. 1973 26 p refs (For availability see N73-20684 11-21)

A review is presented of the basic principles of operation of the dynamically tuned instrument and shows a gyro configuration designed for the strapdown use. Characteristic errors in a multigimbal design are discussed and the basic error models for the gyro, together with its dynamic characteristics, are presented. Author

N73-20698 Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
THE EVOLUTION OF ESG TECHNOLOGY
Robert R. Warzynski and Ronald L. Ringo *In* AGARD Inertial Navigation Components and Systems Feb. 1973 8 p (For availability see N73-20684 11-21)

Two electrostatic gyro (ESG) navigation systems are described: the gimbaled ESG aircraft navigation system (GEANS) and the strapdown ESG micro-navigator (MICRON). The ESG, its drift error sources, the exploratory program that preceded the development of the GEANS and MICRON, and the status of the GEANS and MICRON development are reported. Author

N73-20699* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROGRESS IN STRAPDOWN TECHNOLOGY
J. C. Hung (Tenn. Univ., Knoxville) and G. B. Doane, III *In* AGARD Inertial Navigation Components and Systems Feb. 1973 9 p refs (For availability see N73-20684 11-21)
CSCL 17G

An overview is presented of typical inertial grade instrumentation available to mechanize precision strapdown attitude reference systems as well as a novel scheme of redundancy management, if two degree of freedom instruments are used. The instrumentation is divided between conventional and unconventional sensors with some assessment of their readiness included. Author

N73-20700 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
INERTIAL SYSTEM ENHANCEMENT OF FLIGHT CONTROL
Max L. Lipscomb and Fred D. Smith *In* AGARD Inertial Navigation Components and Systems Feb. 1973 11 p refs (For availability see N73-20684 11-21)

The functions of vehicle flight control to which a quality inertial system will contribute, and in a number of cases make possible, is discussed. The status of programs aimed toward more fully defining and implementing these flight control functions, including all weather landing as well as automatic steering, is outlined with the results achieved to date. Functional requirements which will be levied on the inertial system are listed and examined as to the parameters measured or computed, reliability, criticality relating to flight safety, practicality of the system for broad applications from both simplicity of operation and economical standpoints, and physical aspects. Both established and probable requirements of an acceptable system are noted. The requirements will of necessity stress the fact that such a system is a safety flight item and reliability is extremely critical. A brief survey is presented of the trends and developments toward the systems which will be required to achieve universal integration of inertial navigation system signals into the flight control system functions. Several different types of inertial systems now under development are discussed to illustrate the technology which may yield applicable systems. Author

N73-20701 Army Electronics Command, Fort Monmouth, N.J. Navigation Systems Team.
DESIGN OF A KALMAN DERIVED, FIXED, GAIN, HYBRID NAVIGATION SYSTEM
W. R. Light, Jr., R. F. Clark, C. T. Elliott, M. J. Fisher, C. J. Galanti, J. A. Knight, and I. Levine *In* AGARD Inertial Navigation Components and Systems Feb. 1973 10 p refs (For availability see N73-20684 11-21)

At present, there exists a major effort to develop cost-effective navigation systems for application to U.S. Army aircraft. Major factors involved in the design of one candidate for such an application (a loran/inertial hybrid system) are discussed. The design factors addressed include selection of a measurement processing technique to be used in conjunction with a Kalman filter algorithm, and the modification of this algorithm to provide Kalman derived, fixed feedback gains, free of geographic dependence. Relative performance of the fixed gain and Kalman systems is assessed through analysis of data from both Monte Carlo computer simulations and actual flight test. Author

N73-20702 Steinheil-Lear Siegler A.G., Ismaning (West Germany).
A THREE AXIS GYRO STABILIZED TORPEDO PLATFORM
Gerhard Gerber *In* AGARD Inertial Navigation Components and Systems Feb. 1973 9 p (For availability see N73-20684 11-21)

The design of a three axis platform is described with dimensions of 190 mm in diameter, 225 mm in length, and a weight of 6 kg with a ready time of approximately 10 seconds. The power consumption is equal or less than 35 watts. The attitude is equal or better than 0.3 degrees in roll and pitch with a drift rate (depending on the gyro) of better than 4 deg/h

in azimuth. The platform is supplied with 115 V AC, 3 phase and includes all electronics. Author

N73-20703 Technische Hogeschool Twente, Enschede (Netherlands).
DETERMINATION OF SHIPS ORIENTATION FROM ACCELEROMETER SIGNALS
R. P. Offereins *In* AGARD Inertial Navigation Components and Systems Feb. 1973 9 p refs (For availability see N73-20684 11-21)

A method is described for determining the orientation of a ship using only signals from accelerometers and without the use of gyroscopes. Three rotation accelerometers and two translation accelerometers are necessary. They are rigidly attached to the ship. Their signals and the signal of the compass are processed by a digital computer which performs a sort of filtering process to compute continuously the three angles determining ships orientation. These angles may be used for controlling equipment like radar, guns etc. The advantage of the method as compared with a solution using gyros is the simple and reliable hardware. The critical point will be the accuracy of measurement of rotation acceleration. The computer program has been tested and now experiments are carried out to test the system with a model of a moving ship. Author

N73-20704 Marconi-Elliott Avionic Systems Ltd., Rochester (England). Inertial Navigation Div.
THE USE OF A CLUSTER ROTATED INERTIAL SYSTEM, IN A STRIKE AIRCRAFT ENVIRONMENT
D. G. Harris *In* AGARD Inertial Navigation Components and Systems Feb. 1973 7 p (For availability see N73-20684 11-21)

The Jaguar inertial system is described which involves the use of spatial commutation of the horizontal inertial sensor errors, to achieve the required performance. The development program concerned with the realization of the system is reviewed. A brief review of the theory of cluster rotation and its advantages, is followed by description of the way the technique was applied to improve the performance of an existing platform. Other aspects of the inertial navigation system, where the design was influenced by the use of the rotation technique are then described. The sequence of laboratory and flight trails during which problem areas were discovered, and the methods for solving the problems are discussed. Author

N73-20705 Boeing Co., Seattle, Wash.
DESIGN OPTIMIZATION OF SRAM INERTIAL NAVIGATION AND GUIDANCE
J. H. Whiting and R. D. Thomas (SRAM System Program Office) *In* AGARD Inertial Navigation Components and Systems Feb. 1973 10 p (For availability see N73-20684 11-21)

Since the AGARD Inertial Navigation Symposia in 1967 and 1968, the short range attack missile (SRAM) has progressed from the design phase into production. The United States Air Force's newest strategic weapon is now entering the inventory and will become operational later this year with the first wing of B-52 aircraft modified to carry it. Navigation, guidance and transfer of alignment techniques which were being developed in 1968 have been incorporated into the weapon system and successfully demonstrated on 38 flight tests. A general description of SRAM, unique features of the SRAM inertial navigation and guidance system, and the considerations which led to the final design are presented. Emphasis is placed on in-flight inertial navigation alignment and calibration, and design features which minimize cost. Author

N73-20706 Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).
ADVANCED PROCEDURES FOR SELF-ALIGNMENT AND CALIBRATION OF INERTIAL PLATFORMS
U. K. Krogmann *In* AGARD Inertial Navigation Components and Systems Feb. 1973 18 p refs (For availability see N73-20684 11-21)

Starting with the nonlinear and linear model of the IMU in the gravity-field of the rotating earth it is shown that the state-vector normally cannot be measured directly. An optimal estimator is necessary to estimate system-state at discrete time. Different estimation techniques applicable for alignment and calibration are treated in detail and compared with respect to complexity and efficiency. Closed loop as well as quasi-closed loop techniques are contemplated using Kalman-Filter and weighted least squares. The problem of estimator divergence is discussed briefly. Author

N73-20707 Institut fuer Flugnavigation, Stuttgart (West Germany).
PROCEDURES FOR THE ESTIMATION OF THE IN-FLIGHT VERTICAL MISALIGNMENT OF PLATFORMS
Volkmar Held *In* AGARD Inertial Navigation Components and Systems Feb. 1973 16 p refs (For availability see N73-20684 11-21)

Test flight measurements were made with a single-axis inertial platform mounted in a Transall C 160 test aircraft. For additional velocity information the outputs of the Doppler radar were used. The estimation of the platform vertical misalignment is performed in two different ways: with a so-called 'mean value' procedure which needs only the integral of the platform accelerometer output and the appropriate component of the Doppler velocity and with a Kalman filter. The dynamic and statistic values which are necessary to implement the filter are determined from the flight measurements. Different filter models result in dependence on the platform horizontal reference-axis orientation relative to the aircraft and on the aircraft acceleration according to gusts. The results of the platform misalignment estimation show that the application of a Kalman filter procedure leads in all treated cases to the best estimation accuracy, if an additional velocity measurement is used. If no dippler velocity measurement is available for the estimation, the errors are so large that it is not worthwhile to apply the sophisticated Kalman filter. Author

N73-20708 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
THE MODELLING ERROR SENSITIVITY OF DIGITAL FILTERS FOR THE ALIGNMENT OF INERTIAL PLATFORMS
Heinz Winter *In* AGARD Inertial Navigation Components and Systems Feb. 1973 15 p refs (For availability see N73-20684 11-21)

The effect of incorrect or incomplete modelling of a typical inertial platform in sub-optimal filters, on the alignment and calibration accuracy is analyzed. Closed-loop alignment with a 13-dimensional Kalman filter and open-loop alignment with a 4-dimensional regression filter are considered. Simplifications of the precomputed gain matrix and a fairly simple controller for closed-loop alignment are analyzed with respect to their effect on the alignment accuracy. It is shown that the modelling errors in the 4-dimensional regression filter lead to increasing uncertainty in the platform state estimation after a certain estimation time. The limitation of the azimuth alignment accuracy caused by the east gyro drift is discussed for different drift correlation times between 1.5 seconds and infinite time and is compared with the steady state azimuth alignment error in a third order gyrocompassing loop. Author

N73-20709 Ferranti, Ltd., Edinburgh (Scotland). Inertial Systems Dept.
GYRO CHARACTERISTICS FOR RAPID GYRO-COMPASSING
K. R. Brown and D. Anderson *In* AGARD Inertial Navigation Components and Systems Feb. 1973 18 p ref (For availability see N73-20684 11-21)

Inertial navigation system alignment, of course, includes finding north by gyrocompassing, and around 2.5 minutes must be met if the overall reaction time of the aircraft is not to be limited by the system. It is found that for all practical purposes the equipment must be switched on from cold and this necessitates the use of the inertial instruments before they reach their designed operating temperature. The results are given of a program of work over many years, to determine the parameters of single-axis floated gyroscopes, when used in inertial systems requiring rapid reaction under these conditions. New parameters of gyro drift have been obtained, and the new technique of system operation based on these is outlined. The performance obtained with an inertial navigation system using these techniques is given to illustrate the benefits to be gained. Author

N73-20710 LTV Aerospace Corp., Dallas, Tex.
A-7 AIRCRAFT AIRBORNE, GROUND, AND SHIPBOARD INERTIAL NAVIGATOR ALIGNMENT METHODOLOGY AND RESULTS
M. G. Johnson, Jr. *In* AGARD Inertial Navigation Components and Systems Feb. 1973 10 p (For availability see N73-20684 11-21)

The A-7D/E aircraft navigation system is described and in particular the alignment method. The particular functions which the system performs are outlined. The alignment techniques are described in a basic fashion without delving into a detailed derivation. Finally, some experience gained during the A-7 program is presented along with test results. Author

N73-20711 Norwegian Defence Research Establishment, Kjeller. Div. of Electronics.
PENGUIN MISSILE INERTIAL NAVIGATION SYSTEM-DESIGN CONSIDERATION FOR MIDCOURSE GUIDANCE
H. K. Johansen *In* AGARD Inertial Navigation Components and Systems Feb. 1973 13 p (For availability see N73-20684 11-21)

The midcourse guidance of the Penguin ship to ship missile requires an inertial navigation system for attitude reference and position computation. The INS has a three axis platform with resolver outputs to the guidance system and seeker head. The cross-track position is computed by analog electronics. Later versions also incorporate down range navigation electronics. The mechanical design emphasizes simplicity in assembling and maintenance by making use of a complete package design. A rapid initialization technique for use on board small fast patrol boats is described. In azimuth resolver slaving is used, and leveling is performed by using the platform accelerometers and by compensating for the ship horizontal accelerations. A modified tangent plane navigation scheme is used in the flight mode. Navigation accuracy better than 200 m at 25 km has been demonstrated. Results from error simulations and results from a rocket sled test program are shown. Author

N73-20712 Royal Aircraft Establishment, Farnborough (England). Avionics Dept.
FAULT DETECTION POSSIBILITIES IN A SYSTEM EMPLOYING KALMAN FILTERING
F. Gregson *In* AGARD Inertial Navigation Components and Systems Feb. 1973 10 p refs (For availability see N73-20684 11-21)

Kalman filtering is coming into use as a means of mixing sensor information in an integrated navigation system. Use of the technique, implying knowledge of the errors in the system and their statistics, should provide a basis for fault detection. The report quotes the basic Kalman filtering equations and discusses the indirect implementation normally used in airborne navigation applications. Types of faults in the sensors are categorized according to the way in which they would affect the operation of Kalman filtering. Criteria are established for detecting each category of fault. These are discussed with reference to a Doppler-inertial navigation system. The methods proposed for the detection of faults are shown to be relevant to the problem of divergence encountered in some Kalman filter implementations. It is concluded that it should be possible to detect faults. Location however may not be possible. Author

N73-20713 Singer Co., Little Falls, N.J. Aerospace and Marine Systems Group.
FAULT ISOLATION AND MAINTENANCE CONCEPTS OF AN ADVANCED INERTIAL NAVIGATION SYSTEM
Francis H. Murphy *In* AGARD Inertial Navigation Components and Systems Feb. 1973 9 p (For availability see N73-20684 11-21)

The design concepts, hardware characteristics, and system tradeoffs are described which have been considered for a self-contained advanced inertial navigation system. Included in this system is an automatic self-annunciating fault isolation capability. The system is packaged in a single LRU and has been organized to be modular in construction with fault annunciation to both the module level for flight line level maintenance and to the functional circuit hybrid chip at the intermediate level. Details are presented on the various built-in test functions, as well as validation of the built-in test hardware by utilization of the BITE-on-BITE concept. Software monitoring is discussed, including built-in flight line self-test, calibration and in-flight performance monitoring utilizing existing redundancy within the platform subsystem. The utilization of a calibration computer card is also discussed. This card, an interchangeable replacement for the operational computer card, is utilized to perform periodic calibration of the platform subsystem without the need for any additional external support calibration equipment. The report concludes with a summary of the methods used to fault isolate and the maintenance action required at the various operational levels. Author

N73-20714 Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
ACTIVITIES OF LRBA IN THE INERTIAL DOMAINE [ACTIVITES DU LRBA DANS LE DOMAINE DE L'INERTIE] c14
Jean Moret and Guy Cally *In* AGARD Inertial Navigation Components and Systems Feb. 1973 12 p In FRENCH (For availability see N73-20684 11-21)

The role of LRBA in inertial affairs relative to French military programs and the methods used by the facility to study these systems are briefly outlined. Qualification tests of accelerometer systems for ballistic engine guidance, in environments simulated on a centrifuge, are discussed in detail.
Transl. by E.H.W.

N73-20715 Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
DETERMINATION OF NONLINEAR ACCELEROMETERS BY A METHOD OF DIFFERENTIAL TESTS [DETERMINATION DES NON LINEARITES D'ACCELEROMETRES PAR UNE METHODE D'ESSAIS DIFFERENTIELS] c14
Jean Moret and Guy Cally *In* AGARD Inertial Navigation Components and Systems Feb. 1973 8 p In FRENCH (For availability see N73-20684 11-21)

A differential test method used to evaluate the quality and performance of nonlinear accelerometers is described. Advantages of the method over classical methods, measurement errors, and the results obtained are given. Transl. by E.H.W.

N73-20716 Royal Aircraft Establishment, Farnborough (England). Avionics Dept.
DATUM POSITIONS AND VELOCITIES FOR THE EVALUATION OF INERTIAL NAVIGATION SYSTEMS
R. F. Stokes and S. G. Smith *In* AGARD Inertial Navigation Components and Systems Feb. 1973 21 p (For availability see N73-20684 11-21)

The methods are described which were employed to obtain datum position and velocity information for use in evaluating inertial navigation systems with a performance of around 1 n mile/h. The methods were designed to permit evaluations on a world-wide basis using whatever sources of position information are available. These are usually two inertial navigation systems, a Doppler dead-reckoning position, range-range Tacan or DME, Decca, and loran C. The datum produced has to be accurate enough, and in a suitable form, for use in trying to identify the major sources of system error in the inertial navigation system under test. A lower accuracy datum, only suitable for use in statistical analyses, is also described. Various examples are given of the accuracies of the methods; of the quality of inertial navigation system error information obtained; and of the errors observed in Tacan, Decca and loran C fixes. The methods for identifying error sources are related to the type of datum obtained. The virtues of range-range Tacan, Decca, and loran C for providing fixes for these types of evaluation are also discussed.
Author

N73-20717 Aerospace Guidance and Metrology Center, Newark Air Force Station, Ohio. Plans and Management Staff Office.
LIFE CYCLE COST ANALYSIS OF INERTIAL SYSTEMS FOR AIRCRAFT AND AIR TO SURFACE MISSILES
Donald L. Hardy, Jr. and Russell M. Genet *In* AGARD Inertial Navigation Components and Systems Feb. 1973 5 p refs (For availability see N73-20684 11-21)

Life cycle cost analysis of Inertial Navigation Systems (INS) is becoming more significant to all users today as performance goals more closely achieve their objectives. Cost of ownership

models and analyses were developed that contribute to current and future assessments of this important area. These analyses are based on an extensive accumulation of inertial systems data. The current analyses include a critical assessment of the current model and its data, a taxonomic analysis of INS applications, and a sensitivity analysis of all input model parameters. These analyses have led to development of new models which will more accurately predict the cost of ownership of a given inertial system. The primary usefulness of the models will be for: (1) generalized analysis of, and (2) discrimination between, the cost of ownership of aircraft and air to surface missile inertial systems. Specific references are made to the most sensitive parameters of any cost of ownership analysis concerning inertial navigation systems. These parameters are of great use in knowing how little data is actually needed to make management and technical discussions. The types of decisions and applications managers and design personnel need to make concerning inertial systems are also outlined. Author

N73-20718*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A COMPARISON OF CMG STEERING LAWS FOR HIGH ENERGY ASTRONOMY OBSERVATORIES (HEAOS)
Billy G. Davis 17 Jul. 1972 138 p refs
(NASA-TM-X-64727) Avail: NTIS HC $9.00 CSCL 17G

A comparison of six selected control moment gyro steering laws for use on the HEAO spacecraft is reported. Basic equations are developed to project the momentum and torque of four skewed, single gimbal CMGs into vehicle coordinates. In response to the spacecraft attitude error signal, six algorithms are derived for controlling the CMG gimbal movements. HEAO performance data are obtained using each steering law and compared on the basis of such factors as accuracy, complexity, singularities, gyro hang-up and failure adaption. Moreover, each law is simulated with and without a magnetic momentum management system. The performance of any steering law is enhanced by the magnetic system. Without magnetics, the gimbal angles get large and there are significant differences in steering law performances due to cross coupling and nonlinearities. The performance of the pseudo inverse law is recommended for HEAO. Author

N73-20719# Systems Control, Inc., Palo Alto, Calif.
OCEANIC ATC SURVEILLANCE SYSTEMS STUDY Final Report, Jun. 1971 - Jan. 1973
Feb. 1973 209 p refs
(Contract DOT-TSC-260-2)
(FAA-RD-73-8) Avail: NTIS HC $12.50

A general approach is discussed for modeling the interaction of the major elements of the Oceanic ATC System: (1) the onboard navigation system, (2) the surveillance system, and (3) the ATC procedures. This modeling approach includes the time/position dependence in the description of the navigation drift error and the surveillance positioning error and includes the return maneuvers of aircraft receiving surveillance alarms. In addition, both strategic and tactical control strategies are considered. Using route safety or collision risk as the performance measure it is shown that with all aircraft equipped with INS the lateral separation standard can be reduced from 120 n.mi. to 45 n.mi. and the longitudinal standard from 15 to 10 minutes. If an independent surveillance system is included, the lateral separation can be further reduced to 30 n.mi. Extensive tradeoff studies are performed to determine the most sensitive parameters of the Oceanic ATC System. Author

N73-20720# Federal Aviation Administration, Washington, D.C.
AN OVERVIEW OF THE FAA ENGINEERING AND DEVELOPMENT PROGRAMS, 1973 - 1974
Mar. 1973 64 p refs
(FAA-EM-73-2) Avail: NTIS HC $5.25

FAA efforts to improve aircraft traffic control on the ground, near the airport, and en route are discussed. The engineering and development programs described in this document are intended to assist all airport users and operators, including general aviation, air carriers, and military. The programs will improve the safety and efficiency of air travel and thereby increase its public acceptance. They will benefit passengers, pilots, the airlines, airport operators and aircraft owners alike. Author

N73-20721*# Honeywell, Inc., St. Petersburg, Fla. Aerospace Div.
PERFORMANCE EVALUATION OF A STRAPDOWN ELECTRICALLY SUSPENDED GYRO FOR SPACE Technical Report, 2 Sep. 1971 - 15 Nov. 1972
Donald F. Elwell, John C. Wacker, and James M. Miletich Mar. 1973 79 p
(Contract NAS1-11078)
(NASA-CR-112206) Avail: NTIS HC $6.00 CSCL 17G

The engineering development directed to improvement in strapdown electrically suspended gyro (SD/ESG) readout accuracy are described. The results of this development effort were represented by new and modified parts which were assembled into a strapdown ESG which was evaluated in terms of its readout system accuracy. The program performance goal was the demonstration of gyro readout to an accuracy of 15 arc-seconds or better. The results of calibrating over two sets of data were error amounts of 11.4 and 12.7 arc-seconds rms. The rms values of readout error were 12.7 and 13.8 arc-seconds for two sets of data not included in the calibration. The techniques for rotor preparation which were investigated under this contract included the application of a thin metal coating to the rotor surface in addition to the use of bare, polished beryllium rotors. Patterning application means which were utilized included a laser for pattern exposure of a photoresist coating and a grit-blast patterning machine which applied the pattern directly onto the metal surface of the rotor. Author

N73-20722# Systems Consultants, Inc., McLean, Va. Management and Data Systems Div.
INSTRUCTIONAL MANUAL FOR MEASURING AERONAUTICAL ACTIVITY AT NON-TOWERED AIRPORTS
Bruce Brown and Carl Carlson Feb. 1973 32 p
(Contract DOT-FA72WA-2774)
(SCI-2-2040; FAA-RD-73-19) Avail: NTIS HC $3.75

The procedures that are required to develop accurate estimates of annual traffic levels at non-towered airports are described. Coverage is given to the techniques for estimating local, itinerant and total aircraft operations due to air carrier, military or general aviation activities. In addition, methods for estimating passenger traffic are included. The estimating techniques require that surveys be made to gather samples of traffic activity at the non-towered airports. Guidelines for conducting airport traffic surveys are included and the necessary computational steps for converting the sampled data to annual estimates are defined. Author

N73-20723# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
TRANSIT SIMPLIFIED RECEIVER (TRANSIM): A LOW-COST SATELLITE NAVIGATION SYSTEM, VOLUME 1
D. W. R. Denzler, J. R. Norton, and J. A. Trennepohl Oct. 1972 339 p refs
(Contract N00017-72-C-4401)
(AD-755149; APL-TG-1204-A) Avail: NTIS CSCL 17/7

The report discusses the design and development of the TRANSIM(TRANsit SIMplified Receiver) satellite navigation system. The system consists of the TRANSIM receiver, a programmable electronic calculator, and a receiving antenna. Subsystems of the Navy Navigation Satellite System (i.e., the polar-orbiting earth satellites and the network of tracking stations) are also discussed in addition to integral Doppler navigation theory. The TRANSIM receiver was developed by the Applied Physics Laboratory to meet the need for a simplified, moderately accurate, low-cost satellite navigation receiver. A functional description of the receiver is presented, and operating characteristics are explained. A detailed description of the calculator interface is given, and the complete calculator program is supplied and discussed. Volume I presents a description of the functional components of the TRANSIM system and associated software. Author (GRA)

N73-20724# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
TRANSIT SIMPLIFIED RECEIVER (TRANSIM): A LOW-COST SATELLITE NAVIGATION SYSTEM. VOLUME 2: APPENDIXES
D. W. R. Denzler, J. R. Norton, and J. A. Trennepohl Oct. 1972 200 p

(Contract N00017-72-C-4401)
(AD-755150; APL-TG-1204-B) Avail: NTIS CSCL 17/7

The report discusses the design and development of the TRANSIM (TRANsit SIMplified Receiver) satellite navigation system. The system consists of the TRANSIM receiver, a programmable electronic calculator, and a receiving antenna. Volume II contains the appendixes including a discussion of the skirted dipole antenna, the beep word detector, and navigation and alert program listings. Author (GRA)

N73-20725# Army Missile Command, Redstone Arsenal, Ala. Guidance and Control Directorate.
SPHERICAL HYDROSTATIC GAS BEARING GYRO, PHASE 2
Aubrey Rodgers and Rayburn K. Widner 20 Nov. 1972 20 p
(DA Proj. 1X2-22251-D-231)
(AD-755124; RG-72-20) Avail: NTIS CSCL 17/7

The report summarizes the effort within the Guidance and Control Directorate covering the design, development, and evaluation of a boundary layer pickoff, spherical diamond laps, V-groove rotor alignment, and gyro performance in a 5.3g root mean square random vibration environment. Evaluation results confirm a plus or minus 0.5 psid/deg linear pickoff scale factor with noise peak-to-peak amplitudes less than 0.15 degrees, rotor cavity reproduction of exact dimensions and low torque bearings at minimal fabrication cost, a spin axis repeatability of 0.6-mrad 1 sigma value using V-groove rotor alignment, and a stable bearing when exposed to a random vibration environment.
Author (GRA)

N73-20726# Ohio Univ., Athens. Dept. of Electrical Engineering.
DEVELOPMENT OF A GYRO-LESS DIGITAL FLIGHT DIRECTOR
David L. Horwitz Oct. 1972 65 p refs
(Contract DAAB07-68-C-0084)
(AD-754028; EER-16-11; ECOM-0084-S-2) Avail: NTIS CSCL 17/7

Precise aircraft control is becoming more critical with the present increasing air traffic. This research presents a new type of digital flight director which is free of gyroscopic references. This digital flight director (controller or compensator) is derived by two methods, the (root locus) trial and error method and Truxal's Method. The first method showed the feasibility of a gyro-less controller. Using the second method, a digital flight director is obtained that offers precise aircraft control on a defined route. The derivation and testing of these controllers are discussed in detail in this report. Author (GRA)

N73-20727# Ohio Univ., Athens. Dept. of Electrical Engineering.
OPTIMUM ADAPTIVE PHASE ESTIMATION RECEIVER FOR ONE-WAY RANGING AIRCRAFT NAVIGATION
Patrick H. Garrett Oct. 1972 178 p refs
(Contract DAAB07-68-C-0084)
(AD-754031; EER-16-10; ECOM-0084-S-5) Avail: NTIS CSCL 17/7

The report presents a comprehensive investigation of improved signal processing techniques for precise, low-frequency, one-way ranging for aircraft navigation. Author (GRA)

N73-20728# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
PRESENT AND ADVANCED GUIDANCE TECHNIQUES Final Report, Jan. - Jun. 1972
David W. Whitcombe 1 Nov. 1972 65 p refs
(Contract F04701-72-C-0073)
(AD-754923; TR-0073(3115)-1; SAMSO-TR-72-299) Avail: NTIS CSCL 17/7

Seven guidance equation techniques, both present and advanced, are discussed. Sufficient detail is given so that the basic philosophy and equation development for each technique may be understood. The techniques described are: Q; Delta; Explicit; Linear tangent; Optimal; Numerical integration; Parameter optimization. Both normal and fast reaction targeting concepts are discussed. Comparison is made between the seven techniques with respect to computer storage and speed requirements, targeting requirements, and mission flexibility. Author (GRA)

N73-20729# Naval Training Equipment Center, Orlando, Fla. Computer Lab.
UNDERWATER TERRAIN NAVIGATION AND RECONNAISSANCE SIMULATOR Final Report, Feb. 1970 - Aug. 1971
Emmanuel S. Psarakis Sep. 1972 28 p refs
(AD-754091; NAVTRAEQUIPC-IA-198) Avail: NTIS CSCL 17/7

The continuing growth in the number of deep submersibles used by the Navy has created the need to design a simulator which will be used to effectively train pilots and scientific crews to man these submersibles. The present method of training personnel is by actually making dives in the submersibles. This method is hazardous and costly, and the submersibles are not always readily available. The ideal method of accomplishing a true deep submersible simulation is by driving a simulator using the standard equation of submarine motion solved in a digital computer. In addition, various other submarine systems, such as ballast and trim systems, can also be readily simulated by solving appropriately designed equations in the computer. The report describes the system. Author (GRA)

N73-20730# Aerospace Systems, Inc., Burlington, Mass.
FUNCTIONAL ERROR ANALYSIS AND MODELING FOR ATC SYSTEM CONCEPTS EVALUATION Final Report, May 1971 - May 1972
William C. Hoffman, Walter M. Hollister, and Robert W. Simpson May 1972 107 p refs
(Contract DOT-TSC-212)
(PB-213148; ASI-TR-72-9; DOT-TSC-212-72-1) Avail: NTIS HC $3.00 CSCL 17G

A functional error analysis and modeling study of the air traffic control (ATC) system is described. The work was performed to support the ATC system concepts evaluation program of the Transportation Systems Center (TSC), which will be conducted on their Multi-Modal Transportation System Simulation. The dominant functional error sources in the ATC system are identified and models of these errors are developed for implementation in the TSC simulation. The models are constructed to be as realistic as possible without placing excessive computational requirements on their realization. The models were developed in four categories: target dynamics, air data system, navigation systems and surveillance systems. Author (GRA)

N73-20731# Army Electronics Command, Fort Monmouth, N.J.
DESIGN OF A KALMAN DERIVED, FIXED GAIN, HYBRID NAVIGATION SYSTEM
W. R. Light, Jr., R. F. Clark, C. T. Elliott, M. J. Fisher, and C. J. Galanti Nov. 1972 34 p refs
(DA Proj. 1F1-62202-A-96)
(AD-754548; ECOM-4044) Avail: NTIS CSCL 17/7

At present, there exists a major effort to develop cost-effective navigation systems for applications to U.S. Army aircraft. Major factors involved in the design of one candidate for such an application (a LORAN/Inertial hybrid system) are discussed in this report. The design factors addressed include selection of a measurement processing technique to be used in conjunction with a Kalman filter algorithm, and the modification of this algorithm to provide Kalman derived, fixed feedback gains, free of geographic dependence. Relative performance of the fixed gain and Kalman systems is assessed through analysis of data from both Monte Carlo computer simulations and actual flight tests. Author (GRA)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N73-20732 National Lending Library for Science and Technology, Boston Spa (England).
REACTION AT THE CAN/FUEL INTERFACE IN IRRADIATED FUEL ELEMENTS WITH STAINLESS STEEL CAN
F. DeKeroulas 4 Dec. 1972 10 p refs Transl. into ENGLISH

from J. Nucl. Mater. (Amsterdam), v. 43, 1972 p 313-320 (NLL-CE-Trans-6049-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Reports covering the oxide-can reaction (stainless steel can and (UPu)O(2+x) mixed oxides fuels), thermodynamic data, and experiments on direct compatibility of the can fuel are given. Data are also given on the parts played by tellurium, barium, and cesium iodide. It was concluded that a decrease in the oxygen/metal ratio of the fuel during fabrication and an increase in the chromium content of the steel are likely to restrict the development of the oxide-can reaction. Author

N73-20733*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DYNAMIC ANALYSIS OF AN OPEN-CYCLE GAS-CORE NUCLEAR ROCKET
George E. Turney and Arthur W. Kieffer Washington Apr. 1973 30 p refs
(NASA-TM-X-2784; E-7266) Avail: NTIS HC $3.00 CSCL 21F

Reactivity and flow disturbances were used to investigate the transient response of a conceptual open cycle gas core nuclear rocket engine. The disturbances were made with the system initially operating at its steady state design point. Results of the study show that the feedbacks associated with the propellant density and propellant temperature have a dominant effect on the response of the system. Furthermore, there appears to be a rather limited range of values of these propellant feedback coefficients for which the gas core nuclear rocket has a stable response. The system was rather insensitive to a fuel flow rate disturbance, whereas a similar disturbance in the propellant flow rate caused large changes in reactor power. For a similar disturbance in the propellant flow rate caused large changes in reactor power. For most reactivity and flow rate disturbances, the response showed oscillations of various intensity. Author

N73-20734*# Linguistic Systems, Inc., Cambridge, Mass.
DISPOSAL OF THE RADIOACTIVE WASTES AT TRISAIA NUCLEAR RESEARCH CENTER
A. Marzocchi, G. Cassano, F. Gera, and G. Lenzi Washington NASA Feb. 1973 16 p refs Transl. into ENGLISH from Minerva Fisiconucl. (Turin), v. 15, no. 1, Jan.-Mar. 1971 p 38-45 (Contract NASw-2482)
(NASA-TT-F-14697) Avail: NTIS HC $3.00 CSCL 18G

The method of classification, collection, and treatment of solid and liquid wastes produced at the Trisaia Nuclear Research Center is discussed. The problem caused by the possible migration of radionuclides due to the chronic or accidental loss either from the pits for solid wastes or from liquid containers in the sea is examined in detail. Author

N73-20735*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL DETAILED POWER DISTRIBUTION IN A FAST SPECTRUM THERMIONIC REACTOR FUEL ELEMENT AT THE CORE/BeO REFLECTOR INTERFACE REGION
Paul G. Klann and Edward Lantz 19 Mar. 1973 53 p refs
(NASA-TM-X-68207) Avail: NTIS HC $4.75 CSCL 18H

A zero-power critical assembly was designed, constructed, and operated for the prupose of conducting a series of benchmark experiments dealing with the physics characteristics of a UN-fueled, Li-7-cooled, Mo-reflected, drum-controlled compact fast reactor for use with a space-power conversion system. The critical assembly was modified to simulate a fast spectrum advanced thermionics reactor by: (1) using BeO as a reflector in place of some of the existing molybdenum, (2) substituting Nb-1Zr tubing for some of the existing Ta tubing, and (3) inserting four full-scale mockups of thermionic type fuel elements near the core and BeO reflector boundary. These mockups were surrounded with a buffer zone having the equivalent thermionic core composition. In addition to measuring the critical mass of this thermionic configuration, a detailed power distribution in one of the thermionic element stages in the mixed spectrum region was measured. A power peak to average ratio of two was observed for this fuel stage at the midplane of the core and adjacent to the reflector. Also, the power on the outer surface adjacent to the BeO was slightly more than a factor of two larger than the power on the inside surface of a 5.08 cm (2.0 in.) high annular fuel segment with a 2.52 cm (0.993 in.) o.d. and a 1.86 cm (0.731 in.) i.d. Author

N73-20736*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A PROPOSED EXPERIMENTAL METHOD FOR INTERPRETING DOPPLER EFFECT MEASUREMENTS AND DETERMINING THEIR PRECISION
P. G. Klann Mar. 1973 11 p refs
(NASA-TM-X-68199) Avail: NTIS HC $3.00 CSCL 18I

The principal problem in the measurement of the Doppler reactivity effect is separating it from the thermal reactivity effects of the expansion of the heated sample. It is shown in this proposal that the thermal effects of sample expansion can be experimentally determined by making additional measurements with porous samples having the same mass and/or volume as the primary sample. By combining these results with independent measurements of the linear temperature coefficient and the computed temperature dependence of the Doppler coefficient the magnitude of the Doppler coefficient may be extracted from the data. These additional measurements are also useful to experimentally determine the precision of the reactivity oscillator technique used to measure the reactivity effects of the heated sample. Author

N73-20737# Joint Publications Research Service, Arlington, Va.
NUCLEAR ENGINES IN SPACE
A. Vladimirov 13 Mar. 1973 16 p Transl. into ENGLISH from Nauka Zhizn' (Moscow), no. 8, 1972 p 26-31
(JPRS-58457) Avail: NTIS HC $3.00

The possibilities of using rocket engines with nuclear propulsion systems in spacecraft are examined. Author

N73-20738# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF FAST ATOM INJECTORS FOR THERMONUCLEAR INSTALLATIONS IN THE US
N. N. Semashko [1972] 5 p refs Transl. into ENGLISH from At. Energ. (Moscow), v. 33, no. 1, 1972 p 599-600 Sponsored by AEC
(AEC-tr-7389) Avail: NTIS

Fast particle injectors designed for confinement of plasma in open traps or for heating plasma in closed systems for the purpose of producing shaped flows at tens of amperes and particle energies in the range of units and tens of kiloelectron volts are examined. Author (NSA)

N73-20739# Army Foreign Science and Technology Center, Charlottesville, Va.
THE POSSIBILITY OF APPLYING AN OPEN RESONATOR TO DEVELOP A NARROW-BAND TUNABLE RECEIVER OF MILLIMETER AND SUBMILLIMETER WAVES
A. N. Vystavkin and V. N. Gubankov 31 Oct. 1972 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (Gorkiy), v. 11, no. 5, 1968 p 748-755
(AD-754829; FSTC-HT-23-1030-72) Avail: NTIS CSCL 17/5

The possibility is studied of creating narrow-band, tunable millimeter and submillimeter wave band receivers on the basis of an open resonator containing a volumetric detector. Specific analysis is performed with a detector of n-InSb, cooled to liquid helium temperatures. Author (GRA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N73-20740* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LIGHT INTENSITY STRAIN ANALYSIS Patent
Jerry G. Williams, inventor (to NASA) Issued 13 Feb. 1973 11 p Filed 28 Apr. 1971 Supersedes N71-35132 (09 - 21, p 3527)

(NASA-Case-LAR-10765-1; US-Patent-3,715,915; US-Patent-Appl-SN-138230; US-Patent-Class-73-88A; US-Patent-Class-356-32) Avail: US Patent Office CSCL 20K

A process is described for the analysis of the strain field of structures subjected to large deformations involving a low modulus substrate having a high modulus, relatively thin coating. The optical properties of transmittance and reflectance are measured for the coated substrate while stressed and unstressed to indicate the strain field for the coated substrate.

Official Gazette of the U.S. Patent Office

N73-20741* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

MULTIPLE PASS REIMAGING OPTICAL SYSTEM Patent

William D. Gunter, Jr. and Richard M. Brown, inventors (to NASA) Issued 6 Feb. 1973 7 p Filed 19 Jan. 1971 Supersedes N71-31142 (09 - 18, p 2964)

(NASA-Case-ARC-10194-1; US-Patent-3,715,152; US-Patent-Appl-SN-107659; US-Patent-Class-350-202) Avail: US Patent Office CSCL 20F

An optical imaging system for enabling nonabsorbed light imaged onto a photodetective surface to be collected and reimaged one or more times onto that surface in register with the original image. The system includes an objective lens, one or more imaging lenses, one or more retroreflectors and perhaps a prism for providing optical matching of the imaging lens focal planes to the photo detective surface.

Official Gazette of the U.S. Patent Office

N73-20742 National Lending Library for Science and Technology, Boston Spa (England).

STUDY CONCERNING THE HALF VALUE DEPTH OF REFLECTING ZONES IN ULTRASONIC TESTING

H. Wuestenberg 27 Dec. 1972 19 p refs Transl. into ENGLISH from Material Pruefung (Duesseldorf), v. 13, no. 10, 1971 p 329-335

(NLL-CE-Trans-5993-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Half value depths are often used for classifying echo indications although a monotonic relationship which is independent of the shape of the reflection point generally does not exist between the half value depth and the true size of the defect. In the case of cylindrical holes, for example, the half value depth essentially depends only on the sound field of the probe. In the case of defects with more or less plane reflecting surfaces three types of behavior may be distinguished: (1) The half value depth of small defects depends only on the sound field of the probe. (2) For larger defects the half value depth decreases with increasing reflector size. (3) When defect size is equal to or larger than the diameter of the sound beam the half value depth can be used to describe the extent of the defect. Author

N73-20743# California Inst. of Tech., Pasadena. Big Bear Solar Observatory.

THE FIVE MINUTE PERIOD OSCILLATION IN MAGNETICALLY ACTIVE REGIONS

A. G. Michalitsanos [1972] 30 p refs Sponsored in part by ESRO

(BBSO-0127) Avail: NTIS HC $3.50

The magnetohydrodynamic frequency-wavelength relation, derived by McLellan and Winterberg (1968), was evaluated for anisothermal atmosphere. In particular, the effect which an inclined magnetic field and a finite horizontal wavelength have on the critical sonic and internal-gravity cut-off frequencies was examined, in which it has been assumed that the magnetic field vector, wave vector, and gravity vector are coplanar. It is shown that the frequency band in which vertical wave propagation is impossible in the nonmagnetic photosphere, becomes smaller when an inclined uniform magnetic field is introduced, and that low frequency magnetically coupled internal-gravity waves do not propagate vertically if the horizontal wavelengths associated with this mode are greater than a critical wavelength which decreases with field strength. It is also demonstrated that an inclined magnetic field will inhibit the resonance that occurs at the critical frequency omega sub g in the nonmagnetic atmosphere which is a result consistent with recent observations of the wiggly line structure in active regions. Author

N73-20744# Joint Publications Research Service, Arlington, Va.

CALCULATION OF THE MAGNETIC FIELD IN THE UNIFORM AIR GAP OF ELECTRIC MACHINES

L. V. Staroshchuk 12 Mar. 1973 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Elektromekh. (USSR), no. 2, 1971 p 135-139

(JPRS-58448) Avail: NTIS HC $3.00

A discussion of the various methods employed for the purpose of calculating the magnetic field intensity of ac electrical machinery with a uniform air gap and for electrical machinery with symmetric and asymmetric windings is reported. Author

N73-20745*# California Inst. of Tech., Pasadena.

A RESTRICTED PROOF THAT THE WEAK EQUIVALENCE PRINCIPLE IMPLIES THE EINSTEIN EQUIVALENCE PRINCIPLE

Alan P. Lightman and David L. Lee [1973] 36 p refs Sponsored in part by Imperial Oil

(Grants NGR-05-002-256; NSF GP-28027; NSF GP-36687) (NASA-CR-131420) Avail: NTIS HC $4.00 CSCL 08N

Schiff has conjectured that the weak equivalence principle (WEP) implies the Einstein equivalence principle (EEP). A proof is presented of Schiff's conjecture, restricted to: (1) test bodies made of electromagnetically interacting point particles, that fall from rest in a static, spherically symmetric gravitational field; (2) theories of gravity within a certain broad class - a class that includes almost all complete relativistic theories that have been found in the literature, but with each theory truncated to contain only point particles plus electromagnetic and gravitational fields. The proof shows that every nonmentric theory in the class (every theory that violates EEP) must violate WEP. A formula is derived for the magnitude of the violation. It is shown that WEP is a powerful theoretical and experimental tool for constraining the manner in which gravity couples to electromagnetism in gravitation theories. Author

N73-20746# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

OBTAINING A PLANE COMPRESSION WAVE DURING ELECTRICAL DISCHARGE IN WATER

M. A. Lyubimova 27 Dec. 1972 14 p refs Transl. into ENGLISH from Elektroiskrovaya Obrabotka Metallov (USSR), 1963 p 69-72

(AD-754614; FTD-MT-24-1193-72) Avail: NTIS CSCL 20/3

In the paper the pressure field at a distance of one diameter of the pipe from the boundary of the cavity was investigated. Having assumed that for water an analogous phenomenon takes place, it is possible to present the processes in the pipe in the following manner: part of the front of the initial wave, having diffracted, produced a plane wave near the source. Another part at the investigated distance spread, experiencing multiple reflections. Author (GRA)

N73-20747# Texas Univ., El Paso.

THE THEORETICAL INVESTIGATION OF WIND GRADIENT EFFECTS ON ATMOSPHERIC SHADOW ZONES Technical Report, 2 Aug. 1971 - 30 Sep. 1972

Jesus Roberto Armijo Tamez and Jose Javier Ramirez Sep. 1972 42 p refs

(Contract DAAD07-72-C-0016)

(AD-754634; ECOM-0016) Avail: NTIS CSCL 20/1

A mathematical model is developed in the report for determining the square of the absolute value of the acoustic pressure within a shadow zone of the atmosphere which was produced by wind and temperature gradients. A computer program based on this model is included in the report. This program enables one to calculate the pressure amplitude squared in the shadow zone for a wide range of wind gradients, temperature gradients, and for different source frequencies. Author (GRA)

N73-20748# Naval Research Lab., Washington, D.C.

AN EXPERIMENTAL STUDY OF THE ACOUSTIC FIELD OF A LINE SOURCE COINCIDENT WITH THE FOCAL LINE OF A PARABOLIC-CYLINDER REFLECTOR Interim Report

J. A. Sinsky, Peter H. Rogers, and A. V. Bozzi 20 Dec. 1972 78 p

(RF05121402)

(AD-754063; NRL-7486) Avail: NTIS CSCL 20/1

The acoustic radiation patterns from acoustically soft parabolic reflectors driven by a line source coincident with the focal lines of the reflectors were measured in the NRL Acoustic Research Tank Facility to verify a mathematical model of an ideal parabolic-cylinder reflector. Data taken in the near and far fields of the reflectors at various frequencies between 10 kHz and 40 kHz were plotted together with the theoretically predicted radiation patterns. Agreement is good between theory and experiment. The experiment was performed with a shallow reflector (4.0-inch focal length and 28.3-inch aperture) and with a deep reflector (2.0-inch focal length and 28.4-inch aperture), and all measurements were made in the median planes of the reflectors. Emphasis was placed on careful construction of the parabolic reflectors and precision alignment of the line source. Error analyses were performed to determine the parabolicness of the reflectors and the effect on the radiation pattern of a slight misalignment of the line source. To illustrate the use of the mathematical model as a design tool, curves were plotted showing the reflector performance characteristics as a function of the reflector parameters. Author (GRA)

N73-20749# Stanford Research Inst., Menlo Park, Calif. 09/1
MATERIALS PROCESSING OF RARE EARTH COBALT PERMANENT MAGNETS Semiannual Interim Technical Report, 1 Jan. - 30 Jun. 1972
Paul J. Jorgensen and Robert W. Bartlett Sep. 1972 90 p refs
(Contract F33615-70-C-1624; ARPA Order 1617; SRI Proj. PYU-8731)
(AD-754951; AFML-TR-72-225; SATR-4) Avail: NTIS

The objectives of the program are to investigate materials processing methods with the goal of achieving optimum properties of SmCo5 and other RECo5 compounds as permanent magnets. The primary problem is achieving high magnetic coercivity. Studies to gain further knowledge of the liquid-phase sintering process and magnetic evaluation of sintered alloys were carried. Oxidation invariably accompanies magnet powder processing. Because of the possible connection between oxidation and reduced magnetic coercivity a study of the oxidation kinetics of SmCo5 was begun, emphasizing low oxygen pressures during the initial stages of oxidation at low temperatures and the selective oxidation of samarium by a modified internal oxidation process. GRA

N73-20750# Harry Diamond Labs., Washington, D.C.
GUN-DRIVEN MAGNETIC FLUX COMPRESSION: FEASIBILITY STUDY
Michael J. Vrabel, Richard P. Leavitt, James C. Blackburn, and Philip S. Brody Sep. 1972 20 p refs
(DA Proj. 1T0-61101-A-91A)
(AD-755103; HDL-TR-1613) Avail: NTIS CSCL 20/3

A series of preliminary experiments has demonstrated the feasibility of using a gun-launched projectile to produce magnetic flux compression. The projectile impacts and collapses a coil of triangular cross section into which a 60-kG seed field has been injected by a capacitor bank discharge. The seed field is compressed by a factor greater than 8 to achieve a peak field of 520 kG in a coil volume of 1 to 2 cc. Author (GRA)

N73-20751# Airborne Instruments Lab., Deer Park, N.Y.
THE 10.6 MICROMETER DETECTOR ARRAY Semiannual Technical Report, 1 Aug. - 1 Nov. 1972
R. A. Lange, J. Walczak, and D. Yustein Dec. 1972 32 p refs
(Contract N00014-72-C-0446; ARPA Order 1806)
(AD-754443; AIL-0123-I-2; SATR-1) Avail: NTIS CSCL 17/5

Analyses were performed on various aspects of the multielement heterodyne technology including high density cabling techniques, image plane dissection to provide 10 x 10 (100 element) spatial elements, heating effects in a matrix array, and 4 K cooler requirements to obtain the desired system sensitivity. Measurements were carried out on HgCdTe photodiodes that showed cutoff frequencies of greater than 200 MHz and a maximum noise equivalent power (NEP) of 1.7 x 10 to the minus 19th power W/Hz over the 200 MHz bandwidth. Author (GRA)

N73-20752# Naval Air Development Center, Warminster, Pa. Aero-Electronic Technology Dept.
TRANSMISSION OF LIGHT THROUGH A RANDOMLY SCATTERING MEDIUM
Cyrus Beck 7 Dec. 1972 16 p refs
(AD-754074; NADC-72099-AE) Avail: NTIS CSCL 20/6

A theory of random shallow angle scattering is presented. The dispersion partial differential equation is derived and the dispersion coefficient is introduced. The equation is solved for a spatial impulse. The Modulation Transfer Function and the contrast loss as a function of dispersion coefficient, spatial frequency and distance are derived. Author (GRA)

N73-20753# Ballistic Research Labs., Aberdeen Proving Ground, Md.
LAMP TO PRODUCE RADIATION AT WAVELENGTH LESS THAN OR EQUAL TO 1028A. 1: LyB RADIATION
Aivars Ozollins and Joseph M. Heimerl Sep. 1972 26 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-754572; BRL-MR-2231) Avail: NTIS CSCL 20/6

A hydrogen lamp with a cooled LiF window was constructed. Gas mixtures of Ar + H2, He + H2, and Ar + He + H2 were used in the source. The Ar + H2 mixtures yielded a Lyman beta radiation output which was about a factor of two over the He + H2 mixtures. The ternary mixtures lay in between these limits. It was experimentally found that in the binary mixtures the maximum Lyman beta radiation output occurred at the same H2 flow as the maximum Lyman alpha radiation output. No simple relationship was found for the ternary mixture. Degradation of Lyman beta radiation transmission due to condensation on the cooled LiF window made this type of lamp unsuitable for use after 30 minutes to 1 hour. Author (GRA)

N73-20754# Naval Postgraduate School, Monterey, Calif.
STATISTICAL CONSIDERATIONS TO EXPERIMENTS ON THE SCATTERING OF SOUND BY BUBBLES IN THE UPPER OCEAN
Peter C. C. Wang and Herman Medwin 31 Oct. 1972 39 p refs
(AD-754372; NPS-53WG72101A) Avail: NTIS CSCL 20/1

Stochastic Models are developed to relate the statistics of sound speed fluctuations and bubble density variations as a function of sound frequency in the upper ocean. These predictions from the stochastic model have been compared with ocean experimental data of sound speed modulation in the frequency range 15 to 150 kHz, and show satisfactory agreement. Future experiments and further modification of this model are discussed. Author (GRA)

N73-20755# Naval Ordnance Lab., White Oak, Md.
LONG RANGE ACOUSTIC TRANSMISSION LOSS IN THE NORTHERN DENMARK STRAIT
David L. Bradley and Gabriel M. Colvin 10 Oct. 1972 24 p refs
(AD-754394; NOLTR-72-178) Avail: NTIS CSCL 20/1

Long range acoustic transmission loss measurements were made in the marginal ice zone of the northern Denmark Strait area using two aircraft. One aircraft flew prearranged tracks, dropping standard U.S. Navy explosive charges, while the second aircraft remained in the area of deployed calibrated sonobuoys, acting as a receiving platform. Received signals were recorded broadband aboard the monitoring aircraft. These broadband recordings were analyzed by filtering, squaring and integrating to obtain energy density in selected 1/3 octave bands. Author (GRA)

N73-20756# Oregon Advisory Committee on Environmental Science and Technology, Corvallis.
NOISE POLLUTION Oregon State Univ. Extension Service Circular 807
Robert M. Alexander May 1972 20 p refs
(Grant NSF GT-16)
(PB-213021) Avail: NTIS HC $3.00 CSCL 20A

Noise pollution is now recognized as one of the critical environmental pollution problems. The publication provides some background information on the nature of sound and noise, its more obvious as well as subtle effects on people and communities. It deals with the obvious effects of loss of hearing associated

with extensive and persistent noise levels, the loss of amenities associated with a noisy environment; and the more subtle psychological and physiological effects. A brief review of national, state, and local legislation is given. Author (GRA)

N73-20757# Rhode Island State Planning Program, Providence.
AIRCRAFT NOISE EVALUATION
Jun. 1972 29 p refs Sponsored by HUD
(PB-212875; RISPP-TP-72-23) Avail: NTIS HC $3.00 CSCL 20A

The current methods utilized to measure and evaluate effects of aircraft noise are reported. Composite noise ratings (CNR) developed by the FAA and the noise exposure forecasts (NEF) as developed by the Statewide Planning Program from HUD Noise Assessment Guidelines are analyzed as they apply specifically to the Theodore F. Green State Airport exterior noise standards. The conclusions drawn are: (1) Noise exposure zones delineated by these methods contain a wide range of actual noise conditions which should not be generalized into zones in this manner, (2) The application of these zones to the Theodore F. Green State Airport substantially overstates the number of persons adversely affected by aircraft noise. Author (GRA)

N73-20758# Office of the Secretary of Transportation, Washington, D.C.
TRANSPORTATION NOISE AND ITS CONTROL
Jun. 1972 31 p
(PB-213007; DOT-P-5630.1) Avail: NTIS MF $0.95; SOD HC $0.70 CSCL 20A

The booklet outlines specific aspects of the noise problem caused by the various modes of transportation - sub and supersonic aircraft, highway noise, (trailer trucks, passenger cars, motorcycles, and sports cars), and rapid transit noise. GRA

N73-20759# Wilsey and Ham, South Pasadena, Calif.
AIRCRAFT NOISE IMPACT-PLANNING GUIDELINES FOR LOCAL AGENCIES Final Report
R. Dale Beland and P. Patrick Mann Nov. 1972 254 p refs Prepared in cooperation with Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
(Contract HUD-H-1675)
(PB-213020; WH-979-1) Avail: NTIS HC $6.75 CSCL 20A

Information developed in the Metropolitan Aircraft Noise Abatement Policy Studies reports and other case studies of aircraft noise abatement are analyzed and presented in a form that provides a practical tool for the local planner, local government and others in developing a comprehensive aircraft noise abatement policy and program. The manual contains a discussion of the entire process of developing a noise abatement program including defining the existing noise situation, determining where this noise situation may conflict with existing or proposed development, developing a program for reducing conflicts, evaluating impact of the program on the community, implementing the program through legislation and action programs. Author (GRA)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N73-20760*# New Hampshire Univ., Durham. Space Science Center.
NEUTRON MEASUREMENTS ON THE OGO-6 SPACECRAFT Final Scientific Report
J. A. Lockwood Jan. 1973 85 p refs
(Contract NAS5-9313; Grant NGR-30-002-088)
(NASA-CR-130203) Avail: NTIS HC $6.25 CSCL 20H

The research is reported for the following specific tasks: (1) the design and calibration of a neutron monitor to measure the cosmic-ray neutron leakage from the atmosphere at altitudes from 400 to 1000 km over a range of latitudes from 0 less than gama less than 90 deg; (2) to determine latitude dependence of the cosmic-ray leakage flux; (3) measure the altitude dependence of the cosmic ray neutron leakage flux; (4) measure the energy spectrum of the cosmic-ray neutron leakage flux in the energy range from .01 to 10 MeV; (5) to search for solar neutrons during both quiet times and solar flare events; (6) to evaluate the neutron flux from the interaction of solar protons in the polar latitudes; (7) to determine the angular distribution of the neutron leakage flux as deduced by measurements of the altitude dependence; and (8) verify the solar modulation of cosmic-ray source for the neutron leakage. Since most of the proposed analyses for this project have been published, several reprints are included. Other results which are already in preprint form are attached. Author

N73-20761*# Pittsburgh Univ., Pa. Dept. of Physics.
ANALYTIC CROSS SECTIONS FOR 1 1S, TO 1 1S TO 2 1S, 1 1S TO 2 1P TRANSITIONS IN HELIUM BY ELECTRON IMPACT
C. V. Sukumar and F. H. M. Faisal [1971] 18 p refs
(Grant NGR-39-011-150)
(NASA-CR-131265) Avail: NTIS HC $3.00 CSCL 20H

The 1 1s yields 1 1s elastic and 1 1s yields 2 1s and 1 1s yields 2 excitation cross sections of Helium atoms by collision with a charged particle are obtained as analytic functions of incident velocity. The first order time dependent scattering theory is used. Numerical values of electron -He cross sections are obtained for incident energies in the range 30 eV to 800 eV and compared with earlier Born approximation calculations and with available experimental data. It is found that at 100 eV and above, the present results are in good agreement with the experimental results. They are also closer to the experimental results than the corresponding Born calculations. Author

N73-20762*# Virginia State Coll., Petersburg.
RESEARCH PROGRAM IN NUCLEAR AND SOLID STATE PHYSICS Semiannual Report
Carey E. Stronach 28 Feb. 1973 37 p refs Original contains color illustrations
(Grant NGR-47-014-006)
(NASA-CR-131398) Avail: NTIS HC $4.00 CSCL 20H

The spectra of prompt gamma rays emitted following nuclear pion absorption were studied to determine the states of excited daughter nuclei, and the branching ratios for these states. Studies discussed include the negative pion absorption of C-12, S-32, and N-14; and the positive pion absorption on O-16. Abstracts of papers submitted to the conference of the American Physical Society are included. F.O.S.

N73-20763*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF PRODUCING I-123 Patent Application
James W. Blue, inventor (to NASA) Filed 13 Mar. 1973 11 p
(NASA-Case-LEW-11390-2; US-Patent-Appl-SN-340863) Avail: NTIS HC $3.00 CSCL 20H

Bombarding a cesium heat pipe with high energy particles causes a spallation reaction which produces vapors of xe-123 and contaminants. The contaminants are removed in a dry ice cold trap while the xe-123 condenses in a liquid nitrogen trap where it decays to i-123. NASA

N73-20764# Illinois Univ., Urbana. Dept. of Physics.
QUANTIZATION OF FREE SPIN-TWO FIELDS ON THE LIGHT FRONT
Robert G. Root Mar. 1973 37 p refs
(Grant NSF GP-25303)
(ILL-(TH)-73-1) Avail: NTIS HC $4.00

The free spin-two fields, both massless and massive, can be consistently quantized on a light-front surface, x to the third power = constant. In this formulation, the massless theory is easily shown to be the limit of the massive theory as m squared yields zero. Author

N73-20765*# Linguistic Systems, Inc., Cambridge, Mass.
OPTICAL METHODS OF ATOMIC ORIENTATION AND THEIR APPLICATIONS
A. Kastler Washington NASA Apr. 1973 21 p refs Transl. into ENGLISH from Phys. Soc. (London), sect. a, v. 67, part 10, Oct. 1954 p 853-863 (French language doc.)
(Contract NASw-2482)

NASA-TT-F-14862) Avail: NTIS HC $3.25 CSCL 20H

The optical method of atomic orientation is among the group of methods proposed and in use. The selective optical stimulation of the Zeeman sublevels of an excited atomic level is shown in the polarization of the optical resonance light. By exciting atoms with circularly polarized resonance light, a selective population of Zeeman sublevels of the ground state can be produced. The applications of atoms thus oriented include: in magnetic resonance experiments, in the excited and ground states; the possibility of orienting atomic nuclei, and finally, the production of electrons polarized by the photoelectric effect of oriented atoms. Author

N73-20766# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DEVELOPMENT AND CONTEMPORARY PROBLEMS OF ATOMIC SCIENCE AND ENGINEERING IN THE USSR (SELECTED PARTS)

A. M. Petrosyants 10 Nov. 1972 58 p refs Transl. into ENGLISH from the publ. "Ot Nauchnogo Poiska k Atomnoy Promyshlennosti Razitiye i Sovremennyye Problemy Atomnoy Nauki i Tekhniki v SSSR" Moscow, Atomizdat, 1970 p 269-310

(AD-754040; FTD-MT-24-1401-62) Avail: NTIS CSCL 20/8

The article presents, in popular - scientific form a brief history of the development of Soviet atomic science and technology. It discusses in some detail the nuclear physics laboratories, reactors, and peaceful uses of atomic energy. Some detail is devoted to the developments in atomic science and technology in countries of the Soviet bloc. Author (GRA)

N73-20767# Systems Science and Software, La Jolla, Calif.

RIP (RADIATION INTERACTION PROGRAM): A ONE-DIMENSIONAL MATERIAL RESPONSE CODE

Roland H. Fisher and Harold E. Read Sep. 1972 100 p refs

(Contract DASA01-70-C-0055)

(AD-755147; SSS-R-72-1324; DNA-2993F) Avail: NTIS CSCL 18/8

The Radiation Interaction Program (RIP) was developed and documented as part of the DNA-sponsored PREDIX Program. RIP is a one-dimensional slab geometry, material response code. This code is used to calculate the response of homogeneous materials exposed to X-ray radiation, electron beams, plate impact or an arbitrary time-dependent pressure boundary condition. The report contains a general description of the code, its available options, and descriptions of the primary physical models. In particular the X-ray radiation source routine, equations of state, a rate-dependent strain hardening constitutive model for 6061-T6 aluminum (which also includes a Bauschinger effect on unloading), and material failure models are discussed in this report. Author (GRA)

N73-20768# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

INTERACTIONS OF ENERGETIC NEON WITH EMULSION NUCLEI Physical Sciences Research Papers

Peter J. McNulty and Robert C. Filz 12 Oct. 1972 14 p refs (AF Proj. 8600)

(AD-754247; AFCRL-PSRP-514; AFCRL-72-0607) Avail: NTIS CSCL 20/8

Measurements of interactions of 280 MeV/nucleon neon nuclei from the Princeton Particle Accelerator with nuclei in emulsions are reported. It is found that the dominant mechanism for nucleus-nucleus interactions for incident neon energies as low as 100 MeV/nucleon is the production of charged and/or neutral pions. Author (GRA)

N73-20769# Army Electronics Command, Fort Monmouth, N.J.

BEHAVIOR OF SCALAR AND SPIN 1/2 PARTICLES IN THE FIELD OF TWO INTENSE ELECTROMAGNETIC WAVES

Harry L. Berkowitz Nov. 1972 43 p refs

(DA Proj. 1T0-61102-B-11A)

(AD-754307; ECOM-4046) Avail: NTIS CSCL 20/10

A method for the approximate solution of the Klein-Gordon and Dirac equations for charged particles in the presence of two electromagnetic, noncollinear, transverse plane waves was developed. The solution to the Klein-Gordon equation is a product of functions which are either solutions to linear, ordinary differential equations of the Hill type of solutions to a Volko equation. It is shown that solutions to the Dirac equation can be constructed from sums of functions similar to those mentioned above. The mass-energy relation in this approximation has a complicated dependence on the field strengths and particle momentum. In particular, it was found that a slowly moving particle in an intense standing electromagnetic wave has a mass shift of order (V squared)/(C squared) times that given by second order perturbation theory. Author (GRA)

N73-20770# Pennsylvania Univ., Philadelphia. Lab. for Research on the Structure of Matter.

STRUCTURE OF MATTER RESEARCH, INCLUDING CHEMICAL AND EXTRACTIVE METALLURGY AND MOLECULAR CRYSTALS STUDIES Final Annual Technical Report, 1 Jul. 1971 - 30 Jun. 1972

Eugene R. Nixon 30 Jun. 1972 213 p refs

(Contract DAHC15-67-C-0215)

(AD-754797; ATR-12) Avail: NTIS CSCL 05/2

The University of Pennsylvania Laboratory for Research on the Structure of Matter (LRSM) is an interdisciplinary laboratory dedicated to graduate research and education in the materials sciences. The report presents a condensed account of the research and educational achievements of the LRSM for the academic year 1971-72. The topics studied include: Chemical and extractive metallurgy; Surfaces and interfaces; Molecular crystals; Electronic and magnetic materials; Materials failure criteria.

GRA

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N73-20771*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.

EFFECTS OF PROPAGATION PARALLEL TO THE MAGNETIC FIELD ON THE TYPE 1 ELECTROJET IRREGULARITY INSTABILITY

K. Lee and C. F. Kennel Nov. 1972 21 p refs

(Grants NGL-05-007-190; NSF GA-34148X)

(NASA-CR-131359; Publ-1076; PPG-137) Avail: NTIS HC $3.25 CSCL 20I

A simple analysis is presented which indicates that Type 1 irregularities which have a slight component of propagation along the magnetic field may be more unstable than those which propagate across the field. It was found that significant irregularity amplitudes may occur at the northern or southern extremities of the equatorial electrojet from those modes with large north-south group velocity, and they could significantly change our understanding of nonlinear solutions of the electrojet instability.

Author

N73-20772*# Florida Univ., Gainesville. Dept. of Nuclear Engineering Sciences.

THE EMISSION COEFFICIENT OF URANIUM PLASMAS

R. T. Schneider, H. D. Campbell, and J. M. Mack Jan. 1973 27 p refs

(Grant NGL-10-005-089)

(NASA-CR-131319) Avail: NTIS HC $3.50 CSCL 20I

The emission coefficient for uranium plasmas (Temperature: 8000 K) was measured for the wavelength range (200 A - 6000 A). The results are compared to theory and other measurements. The absorption coefficient for the same wavelength interval is also given. Author

N73-20773# National Oceanic and Atmospheric Administration, Boulder, Colo. Aeronomy Lab.

LABORATORY INVESTIGATIONS OF DRIVEN LOW FREQUENCY PLASMA OSCILLATIONS

Edward J. Yadlowsky and Paul D. Goldan Jan. 1973 15 p refs

(Contract AT(49-8)-3006)

(NOAA-TM-ERL-AL-5) Avail: NTIS HC $3.00

The parametric decay instability in an unmagnetized plasma is studied. It is shown that low frequency oscillations can be excited by applying RF potentials in conjunction with dc

potentials to grids immersed in the plasma, in addition to the well known oscillations excited with dc potentials alone. Some of the low frequency oscillations exhibit the characteristics of ion-acoutic waves associated with excitation of the parametric decay instability; however, the characteristics of all the oscillations are similar and are though to be the same phenomenon excited by different techniques. Author

N73-20774# Sydney Univ. (Australia). School of Physics.
A 337 mum HCN LASER INTERFEROMETER FOR PLASMA DIAGNOSTICS
N. R. Heckenberg, G. D. Tait, and L. B. Whitbourn Jun. 1972 68 p refs Submitted for publication
(NP-19595; ER-67) Avail: AEC Depository Libraries

A self-modulating laser interferometer incorporating a 337-micrometer HCN laser is described, and a simple theory of its operation is developed. This theory shows that the long lifetimes of levels involved in molecular laser transitions may cause a peaked frequency response in such an instrument. Experimental observations indicate a flat frequency response up to maximum attained fringing rate of 10 kHz. The interferometer was used to make electron density measurements for an effective path length of 150 cm in a decaying helium plasma. The interferograms obtained show a marked variation in fringe amplitude that is attributed to the refractive effects of electron density gradients in the plasma. Author (NSA)

N73-20775# Ballistic Research Labs., Aberdeen Proving Ground, Md.
INITIAL APPEARANCE OF HIGHLY CHARGED IONS FROM MAGNESIUM SURFACES IRRADIATED BY Q-SWITCHED RUBY PULSES
Charles R. Stumfel, Joseph L. Robitaille, and Hans-Joachim D. Kunze Aug. 1972 28 p refs Submitted for publication
(AD-755119; BRL-1619) Avail: NTIS CSCL 20/9

The time development of line radiation emitted from a plasma produced by focusing a Q-switched ruby laser onto a solid magnesium target has been investigated in the vacuum-ultraviolet wavelength region using a 2 m grazing incidence monochromator. The electron temperature was obtained using the foil-absorption method. The time of appearance of Mg IX and Mg X ions at the target was measured as a function of the laser power. It was found, that with increasing power the ions appear earlier, Mg IX before Mg X, until for the higher powers used they appeared at about the same time, 2 nsec after the beginning of the laser pulse. The ionization processes occurring in front of the target are discussed using a simple model for the plasma. From the time of appearance of the lines conclusions on the electron temperature in the heating zone can be drawn as well as on an overall heating rate. Author (GRA)

N73-20776# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
HIGH PRESSURE PLASMA RESEARCH Final Report, Jul. 1965 - Apr. 1972
Uwe H. Bauder Aug. 1972 18 p refs
(AF Proj. 7063)
(AD-754020; ARL-72-0104) Avail: NTIS CSCL 20/9

The research goals, the approach, and the results of the High Pressure Plasma Research, Group V-4, are presented. Also included is a brief description of Air Force applications of this research as well as comprehensive list of publications and presentations as they were generated by in-house and contractual efforts. Author (GRA)

N73-20777# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
HIGH TEMPERATURE PLASMA DIAGNOSTICS AND PROPERTIES Final Report, Jul. 1965 - Jun. 1972
Paul W. Schreiber and Allen M. Hunter, II Aug. 1972 24 p refs
(AF Proj. 7063)
(AD-754021; ARL-72-0102) Avail: NTIS CSCL 20/9

The report is a close out synopsis of Work Unit LV-14, Project 7062 of the Thermomechanics Research Laboratory, Aerospace Research Laboratories. The synopsis covers the period from July 1965 to June 1972. Details of the work accomplished during this period may be found in the literature cited in the bibliography of the synopsis. Author (GRA)

N73-20778# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
STABLE CONFIGURATION OF ELECTRIC ARCS IN TRANSVERSE MAGNETIC FIELDS Interim Report
Herbert O. Schrade Aug. 1972 31 p refs
(AF Proj. 7063)
(AD-754022; ARL-72-0109) Avail: NTIS CSCL 20/9

Deviations from rotational symmetry of arc columns exposed to transverse magnetic fields cause convection and a momentum transport between the column and its surrounding gas. As a consequence, the arc moves and changes its geometry until it reaches a stable configuration. Based on the momentum transport equation, the arc behavior is discussed under various operating conditions, and stable arc configurations are determined. In particular, the stability-criteria of a balanced arc column in a transverse gas flow and magnetic field is derived. Author (GRA)

N73-20779# Technology, Inc., Dayton, Ohio.
THE USE OF EM ACCELERATORS IN HIGH PRESSURE TEST FACILITIES Interim Report
Gordon L. Cann May 1972 34 p refs
(Contract F33615-71-C-1463; AF Proj. 7063)
(AD-754024; ARL-TR-72-0061) Avail: NTIS CSCL 20/9

The performance of steady-state axisymmetric accelerators is investigated under the assumption that they tend to operate in a minimum potential mode. The existence of a critical or Alfven exhaust velocity and of a critical mass flow rate is shown to follow logically from this assumption. The concept of Alfven velocity is extended to include the effects of multiple ionization and or multiple species in the propellant exhaust. Experimental data is correlated using expressions derived from the analysis. It is concluded that this simple general approach explains first order effects quite well in electromagnetic accelerators.
Author (GRA)

N73-20780# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
AN IMPROVED TABULATION OF THE PLASMA DISPERSION FUNCTION AND ITS FIRST DERIVATIVE. PART 1: ARGUMENT WITH POSITIVE IMAGERY PART
Henry E. Fettis, James C. Caslin, and Kenneth R. Cramer Jul. 1972 419 p
(AF Proj. 7071)
(AD-753986; ARL-72-0056-Pt-1) Avail: NTIS CSCL 20/9

A ten-D table of the plasma dispersion function z(x,y) is identical to z(x + iy) together with its first derivative in the complex plane, for x = 0(.1)20 and y = 0(.1)10 are given.
Author (GRA)

N73-20781# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
AN IMPROVED TABULATION OF THE PLASMA DISPERSION FUNCTION AND ITS FIRST DERIVATIVE. PART 2: ARGUMENT WITH NEGATIVE IMAGINARY PART: ZEROS AND SADDLE POINTS Final Report
Henry E. Fettis, James C. Gaslin, and Kenneth R. Cramer Jul. 1972 442 p refs
(AD-754002; ARL-72-0057-Pt-2) Avail: NTIS CSCL 20/9

The report gives a ten-D table of the plasma dispersion function z(x,y) is identically equal to z(x + iy) together its first derivative in the complex plane for x = 0(.1)20 and -y = 0(.1)10. Also included are the first 200 zeros of this function and its derivative, as well as the first 200 zeros of the error function to which the above is closely related. Author (GRA)

N73-20782# Case Western Reserve Univ., Cleveland, Ohio. Div. of Electrical Engineering and Applied Physics.
ELECTROMAGNETIC INTERACTIONS WITH PLASMAS AND TURBULENT MEDIA Final Report, 30 Oct. 1967 - 30 Sep. 1972
Robert E. Collin 25 Oct. 1972 58 p refs
(Contract F19628-68-C-0088; AF Proj. 5635)
(AD-754904; AFCRL-72-0658) Avail: NTIS CSCL 20/9

The report presents a summary of work done on propagation through a turbulent plasma sheath. The Greens dyadic for a

warm plasma sheath is presented along with its adjointness and reciprocal properties. The coherence tensor for the electric field transmitted through the sheath is given for the case of a plane wave incident on the sheath and using the Born approximation. It is shown that for the typical plasma parameters encountered during re-entry that a cold plasma model is adequate to describe the noise induced due to turbulence. Author (GRA)

N73-20783# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EVALUATION OF THE POSSIBILITIES OF USING A POWERFUL BEAM OF RELATIVISTIC ELECTRONS FOR THERMONUCLEAR FUSION
M. V. Babykin, E. K. Zavoiskii, A. A. Ivanov, and L. I. Rudakov 10 Jan. 1973 22 p refs Transl. into ENGLISH from "Dokl., Konf. po Issled. v Obl. Fiz. Plazmy i Upravlyayemykh Termoyadernykh Reaktsiy, Moscow, 17-23 Jun. 1971" 1971 p 1-16
(AF Proj. M122)
(AD-754621; FTD-MT-24-1257-72) Avail: NTIS CSCL 20/9
The author discusses certain technical problems involved in the method of beam focusing, collective beam deceleration, heating of the plasma target, creating the necessary power source, and the problem of rapid power switching. Author (GRA)

N73-20784# Wisconsin Univ., Madison. Mathematics Research Center.
MAGNETOHYDRODYNAMIC STREAMING FLOW PAST A SPHERE AT LOW HARTMANN NUMBERS Technical Summary Report
Rudolph Mathon and K. B. Ranger Nov. 1972 22 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-755060; MRC-TSR-1275) Avail: NTIS CSCL 20/9
The streaming flow of a weakly conducting viscous fluid past a non-conducting sphere in the presence of an aligned uniform magnetic field is investigated for low Hartmann number using a Galerkin method. If convection effects are neglected it is found that eddies occur symmetrically fore and aft of the sphere when the Hartmann number exceeds 2.9. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N73-20785 National Lending Library for Science and Technology, Boston Spa (England).
DIFFUSION ALONG GRAIN BOUNDARIES AND DISLOCATIONS
J. Mimkes 27 Dec. 1972 11 p refs Transl. into ENGLISH from Ber. Deut. Keram. Ges. (West Germany), v. 48, no. 8, 1971 p 355-358
(NLL-CE-Trans-6043-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon
Solutions are given for the diffusion along grain boundaries and dislocations for a finite source. The solutions for infinite sources are calculated by integration from those for finite sources. Solutions for three common experimental methods are discussed using examples from the literature, namely Ni(2+) diffusion along grain boundaries in MgO, Te self-diffusion along dislocations and Ni(2+) diffusion along dislocations in MgO. Author

N73-20786 National Lending Library for Science and Technology, Boston Spa (England).
CALCULATING THE STRESS FOR THERMAL BREAKDOWN IN A SOLID DIELECTRIC
M. I. Mantrov 27 Dec. 1972 12 p refs Transl. into ENGLISH from Elektrichestvo (USSR), no. 4, Apr. 1970 p 74-76
(NLL-CE-Trans-5560-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon
An analytic and a graphical analysis of thermal breakdown phenomena in a solid dielectric is presented. Expressions are given for dc and ac dielectric breakdown voltages. A worked example is appended. Author

N73-20787 National Lending Library for Science and Technology, Boston Spa (England).
SURFACE SPACE CHARGE EFFECT ON CERTAIN PHOTOELECTRIC PROPERTIES OF GALLIUM ARSENIDE (p-TYPE)
O. Yu. Borkovskaya et al 4 Dec. 1972 7 p refs Transl. into ENGLISH from Ukr. R. Fiz. Zh. (USSR), v. 17, no. 5, May 1972 p 835-838
(NLL-DRIC-Trans-2913-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon
An examination was made of the spectral and temperature characteristics of natural photoconductivity and condensation photo emf in p-type GaAs. The effects of external transverse electrical field and constant brightness were also measured. The GaAs investigated cover low resistance, average conductivity, and high resistance types. Author

N73-20788 National Lending Library for Science and Technology, Boston Spa (England).
SMALL ETCHING PITS IN EPITAXIAL GALLIUM ARSENIDE
O. M. Ivleva and M. P. Yakubeniya 4 Dec. 1972 6 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Fiz. (Tomsk), v. 1, 1971 p 148-149
(NLL-DRIC-Trans-2928-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon
Etching pits in the epitaxial layer of single crystals of gallium arsenides were investigated. Gallium of n-type and p-type conductivity were used in the preparation of the base layer. It was found that a band of small etching pits formed over the base layer, and the width of the band does not depend on the time of growth of the epitaxial layer. It is concluded that the small etching pits can be attributed to the accumulation of atoms of impurities. F.O.S.

N73-20789 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF FLAWS ON THE PROPERTIES OF SILICON NITRIDE FILMS
V. F. Synorv 4 Dec. 1972 5 p refs Transl. into ENGLISH from Neorg. Mater. (USSR), v. 6, no. 5, 1970 p 1002-1003
(NLL-DRIC-Trans-2902-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon
A three-dimensional model of Si3N4 polymer with flawed covalent bonds was studied in an effort to explain flaws in the amorphic films. For crystal bodies a flaw is determined by a geometric criterion: any disruption of an ideal ordered structured is a flaw. The geometry of the structure of heterogeneous Si3N4 polymer is determined by the spatial direction of the valent bonds. Author

N73-20790 National Lending Library for Science and Technology, Boston Spa (England).
SYNTHESIS OF HIGH RESISTANCE INDIUM PHOSPHIDE
S. P. Staroceltseva [1972] 5 p ref Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Neorg. Mater. (USSR), v. 8, 1972 p 1491-1492
(NLL-RRE-Trans-381-(8036.625)) Avail: Natl. Lending Library, Boston Spa, Engl: 1 NLL photocopy coupon
The synthesis of stoichiometric crystals of indium phosphide doped with impurities was investigated for obtaining a semiconductor with a desired specific resistance. The results of doping with copper, iron, and chromium are reported. F.O.S.

N73-20791*# Utah Univ., Salt Lake City. Microwave Device and Physical Electronics Lab.
AN IMPEDANCE ANALYSIS OF DOUBLE-STREAM INTERACTION IN SEMICONDUCTORS
P. W. Chen and C. H. Durney 1 Jul. 1972 169 p refs
(Grant NGR-45-003-027)
(NASA-CR-131293; UTEC-MD-72-138) Avail: NTIS HC $20.50 CSCL 20L
The electromagnetic waves propagating through a drifting semiconductor plasma are studied from a macroscopic point of view in terms of double-stream interaction. The possible existing waves (helicon waves, longitudinal waves, ordinary waves, and pseudolongitudinal waves) which depend upon the orientation of the dc external magnetic field are derived. A powerful impedance concept is introduced to investigate the wave behavior of longitudinal (space charge) waves or pseudolongitudinal waves

in a semiconductor plasma. The impedances due to one- and two-carrier stream interactions were calculated theoretically.
Author

N73-20792*# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
METHODS OF MEASUREMENT FOR SEMICONDUCTORS MATERIALS, PROCESS CONTROL, AND DEVICES Quarterly Report, 1 Jul. - 30 Sep. 1972
W. Murray Bullis, ed. Mar. 1973 54 p refs
(NASA Order S-70003-G; NASA Order H-87437-A)
(NASA-CR-131275; NBS-TN-754) Avail: NTIS MF $0.95; SOD HC $0.80 domestic postpaid or $0.55 GPO Bookstore CSCL 20L

This progress report describes NBS activities directed toward the development of methods of measurement for semiconductor materials, process control, and devices. Significant accomplishments during this reporting period include design of a plan to provide standard silicon wafers for four-probe resistivity measurements for the industry, publication of a summary report on the photoconductive decay method for measuring carrier lifetime, publication of a comprehensive review of the field of wire bond fabrication and testing, and successful completion of organizational activity leading to the establishment of a new group on quality and hardness assurance in ASTM Committee F-1 on Electronics. Work is continuing on measurement of resistivity of semiconductor crystals; characterization of generation-recombination-trapping centers in silicon; study of gold-doped silicon; development of the infrared response technique; evaluation of wire bonds and die attachment; and measurement of thermal properties of semiconductor devices, delay time and related carrier transport properties in junction devices, and noise properties of microwave diodes. Author

N73-20793*# Linguistic Systems, Inc., Cambridge, Mass.
SOLAR ELEMENTS BASED ON HETEROJUNCTION OF P-TYPE GaAs(1-X)Px AND N-TYPE GaAs
A. G. Cheban, V. V. Negreskul, P. T. Oush, L. V. Gorchak, G. I. Ungurianu, and V. G. Smirnov Washington NASA Apr. 1973 8 p refs Transl. into ENGLISH from Geliotekh., Akad. Nauk Uzb. SSR (USSR), no. 1, 1972 p 30-33
(Contract NASw-2482)
(NASA-TT-F-14859) Avail: NTIS 20 b

Measured dark current-voltage characteristics, light current-voltage characteristics under load, and spectral response curves are given for photosensitive elements prepared by liquid epitaxial growth of p-type GaAs/1-x/P/x/ on an n-type GaAs substrate. Due to the absence of a conditioning surface layer, 30% of the radiation incident on the working surface is reflected, yielding an efficiency of 6 to 7%. Recommendations are given for improvement in this area. Author

N73-20794*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH FIELD SUPERCONDUCTIVITY IN ALKALI METAL INTERCALATES OF MoS2
John A. Woollam, Dennis J. Flood, David E. Wagoner, Robert B. Somoano, and Alan Rembaum 1973 14 p refs Presented at the Am. Phys. Soc., San Diego, Calif., 19-23 Mar. 1973
(NASA-TM-X-68206) Avail: NTIS HC $3.00 CSCL 20L

In the search for better high temperature, high critical field superconductors, a class of materials was found which have layered structures and can be intercalated with various elements and compounds. Since a large number of compounds can be formed, intercalation provides a method of control of superconducting properties. They also provide the possible medium for excitonic superconductivity. Results of magnetic field studies are presented on alkali metal (Na, K, Rb, and Cs) intercalated MoS2 (2H polymorph). Author

N73-20795# Technische Universitaet, Brunswick (West Germany). Fakultaet fuer Maschinenbau und Elektrotechnik
REGULATION OF CARRIER DURABILITY IN SILICON TECHNOLOGY Ph.D. Thesis [EINSTELLUNG DER TRAEGERLEBENSDAUER IN DER SILIZIUM-TECHNOLOGIE]
Joseph Louis Lambert 1972 99 p refs In GERMAN
Avail: NTIS HC $7.00 CSCL 20L

Lifetimes of defect electrons in gallium diffusion thyristor structures are studied by introduction of gold recombination centers and by development of a getter method to obtain high lifetime values. A gallium diffusion method using liquid gallium silicon surface layers produces optimal minority carrier lifetimes up to 300 microseconds. The structural dependence of the gold diffusion reaction results in uneven distributions of minority carrier lifetimes in crystals with different hole generation rates.
Transl. by G.G.

N73-20796# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
[RESEARCH PROGRESS IN CRYSTALS AND SOLIDS, REACTOR TECHNOLOGY, AND THERMONUCLEAR AND TRANSURANIUM PROJECTS] Annual Progress Report, period ending 30 Jun. 1972
Sigfred Peterson, comp. Sep. 1972 207 p refs
(Contract W-7405-eng-26)
(ORNL-4820) Avail: NTIS

Research progress is reported in six sections. A separate abstract was prepared for each section. NSA

N73-20797# Duke Univ., Durham, N.C. Dept. of Physics.
A TECHNIQUE FOR GROWING HELIUM CRYSTALS IN PREFERRED ORIENTATIONS
D. T. Lawson Jan. 1973 32 p refs
(Contract N00014-67-A-0251-0014)
(AD-754442; DUP-73-2) Avail: NTIS CSCL 20/12

An apparatus has been developed in which hcp 4He single crystals of high quality are grown with a 0.3 probability of obtaining c-axis orientations of 0 or 90 deg with respect to the direction of growth. Methods of influencing the relative distribution of crystals between these two angles have been observed and are believed to depend on the anisotropy in the thermal conductivity of hcp 4He. A simple computer simulation of the nucleation process supports our identification of the orientation angles and our explanation of the observed orientation preferences. Some possible applications of similar techniques were surveyed.
Author (GRA)

N73-20798# Duke Univ., Durham, N.C. Dept. of Physics.
THERMAL CONDUCTIVITY AND ISOTOPIC IMPURITIES IN SINGLE CRYSTALS OF HELIUM
D. T. Lawson and H. A. Fairbank Jan. 1973 71 p refs
(Contract N00014-67-A-0251-0014)
(AD-754475; DUP-73-1) Avail: NTIS CSCL 20/12

The authors used the enhancement of thermal conductivity by Poiseuille flow of the phonon gas to obtain highly sensitive measurements of phonon scattering by isotopic impurities in single crystals of helium. Crystal orientation, size, and quality may be inferred from the thermal conductivity data themselves. The hcp 4He crystals were grown at a constant pressure of 85.1 atm using an apparatus and techniques which made possible some control over crystal orientation. In the Poiseuille region a relaxation time limit has been achieved experimentally which allows the data to be fitted as a function of temperature and concentration with only one parameter. The observed scattering strength is a factor of 2.7 greater than can be explained in terms of mass defect scattering alone. A number of current theories are examined in the light of this result. Author (GRA)

N73-20799# Army Electronics Command, Fort Monmouth, N.J.
TRANSMISSION LINE ANALOGS FOR STACKED PIEZOELECTRIC CRYSTAL DEVICES
Arthur D. Ballato Oct. 1972 21 p refs
(DA Proj. 1S6-62703-A-058)
(AD-754545; ECOM-4041) Avail: NTIS CSCL 09/1

An equivalent circuit consisting of transmission lines and lumped elements is shown to be the exact quasi-static representation of a stack of piezoelectrically driven thickness-mode crystal vibrators. The stack may consist of any number of layers, each of which may be arbitrarily anisotropic, but homogeneous. Thickness- or lateral-field excitation may be used to drive one or any combination of the plates. A canonic element, consisting of two layers, forms the basis for deriving the network representation, which is then generalized to stacks of any number of strata. In a vibrating system of this type, the crystal comprising each layer is represented, in the bulk, by three acoustic transmission lines. Each interface, however, appears as lumped transformer elements coupling together the six transmission

lines incident upon that boundary from the media on both sides. Incorporation of the piezoelectric drive mechanism is shown to require an additional simple network and interconnection. The analysis brings under systematic treatment crystal resonators and filters, delay lines, and pulse and code generators. Some practical applications are illustrated by computer simulation of new device characteristics. Author (GRA)

N73-20800# Radio Corp. of America, Princeton, N.J.
DEFECT CHARACTERIZATION IN 3-5 COMPOUNDS Final Report, 6 Dec. 1971 - 5 Dec. 1972
Marvin S. Abrahams Dec. 1972 43 p refs
(Contract N00019-72-C-0145)
(AD-754821; PRRL-73-CR-2) Avail: NTIS CSCL 20/12

Homoepitaxial films of GaAs deposited from the vapor phase grow by the nucleation and coalescence of islands. The islands coalesce to form a continuous layer when their thickness equals 750 plus or minus 250 A. A pseudomorphic layer of GaAs has been found in growths of undoped or lightly doped GaAs on heavily-doped (Te) substrates. The position of the dislocations was an order of magnitude closer to the original growth interface than that point where they are initially expected to be found in the crystal. Reversing the role of substrate and epitaxial layer by growing Se-doped layers of various concentrations onto undoped substrates has led to further insights: (a) strain-induced precipitation of dopant atoms occurs as a strain-relief mechanism, and (b) observations of orthogonal, cross-sectional specimens have revealed that dislocations for the zincblende structure are asymmetric. Author (GRA)

N73-20801# California Univ., Berkeley. Lawrence Berkeley Lab.
THE APPLICATION OF THE SHUNTED JUNCTION MODEL TO POINT CONTACT JOSEPHSON JUNCTIONS
Yuan Taur, Paul L. Richards, and Franz Auracher Aug. 1972 15 p refs Submitted for publication
(Contracts N00014-69-A-0200-1056; W-7405-eng-48; Grant DA-ARO(D)-31-124-70-G60)
(AD-754082; LBL-1136) Avail: NTIS CSCL 20/12

The authors study the dc I-V characteristics of oxidized Nb-Nb point contacts as a function of temperature, contact pressure, and rf power at 36 GHz. Results for junctions which do not show hysteresis have been compared in detail with calculations from the resistively shunted junction (RSJ) model first proposed by McCumber. The agreement between the data and the RSJ model, with a constant shunt resistance and including the effects of noise, is significantly better than has been reported for Dayem bridges. Author (GRA)

N73-20802# Sperry Rand Research Center, Sudbury, Mass.
PARAMETRIC INTERACTION OF MAGNETOSTATIC AND MAGNETOELASTIC WAVES IN EPITAXIAL YIG FILMS Annual Report, 1 Oct. 1971 - 31 Dec. 1972
Herman VandeVaart Dec. 1972 30 p refs
(Contract N00014-69-C-0027; NR Proj. 017-502)
(AD-754106; SRRC-CR-72-16) Avail: NTIS CSCL 20/12

The report consists of two parts. First the characteristics of magnetostatic surface waves in a transversely magnetized YIG film are described and the conditions required to observe the convolution of two countertraveling magnetostatic waves are discussed. In the second part the experiments that have been performed under the contract are described. Magnetostatic surface waves have been observed. The convolution experiments were inconclusive. Author (GRA)

N73-20803# California Univ., Berkeley. Lawrence Berkeley Lab.
OBSERVABILITY OF QUASIPARTICLE-PAIR INTERFERENCE CURRENT IN SUPERCONDUCTING WEAK LINKS
Franz Auracher, Paul L. Richards, and Gene I. Rochlin Nov. 1972 19 p refs Submitted for publication
(Contracts N00014-69-A-0200-1056; W-7405-eng-48; Grant DA-ARO(D)-31-124-70-G60)
(AD-754081; LBL-1197) Avail: NTIS CSCL 20/12

Calculations of static I(o)-V(o) curves, and of the heights of steps induced by rf radiations, have been carried out for current biased Josephson junctions with both a phase-independent quasiparticle conductance G(o) and a phase-dependent quasiparticle pair interference conductance G(1) cos(phi). Little or no effect of the term in G1 cos(phi) is found for junctions with zero capacitance. It thus appears that this term can be neglected in many practical applications of weak links. Author (GRA)

N73-20804# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF ELECTRON-PHONON INTERACTION ON THE PARAMAGNETISM OF METALS
A. I. Mitsek and A. Ya. Fishman 17 Nov. 1972 12 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (USSR), v. 31, no. 4, 1971 p 894-896
(AF Proj. 7351)
(AD-753984; FTD-HT-23-1211-72) Avail: NTIS CSCL 20/12

The effect of electron phonon interaction on the temperature dependence of paramagnetic susceptibility was examined. This effect should be substantially above the Debye temperature. When taking into consideration the electron phonon interaction, the calculated Fermi energy is a linear function of temperature above the Debye temperature. Author (GRA)

N73-20805# Alabama Univ. Research Inst., Huntsville.
A NEW APPROACH TO THE FINITE-ELEMENT FORMULATION AND SOLUTION OF A CLASS OF PROBLEMS IN COUPLED THERMOELASTOVISCOPLASTICITY OF CRYSTALLINE SOLIDS
J. T. Oden, D. R. Bhandari, G. Yagawa, and T. J. Chung Sep. 1972 30 p refs
(Contract F44620-69-C-0124)
(AD-754952; UARI-RR-131; AFOSR-73-0113TR) Avail: NTIS CSCL 20/12

A new and general theory of thermoelastoviscoplasticity which does not involve a yield function used in conjunction with the finite element method to develop discrete models of a wide class of problems in nonlinear continuum problems and coupled thermoviscoplasticity is given. Author (GRA)

N73-20806# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary, 1 Aug. - 31 Oct. 1972
Melvin A. Herlin, Herbert G. Weiss, and Alan L. McWhorter 15 Nov. 1972 32 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-754945; ESD-TR-72-258) Avail: NTIS CSCL 20/12

Contents: Integrated circuit processing; Photolithographic interconnection of plastic-embedded semiconductor chips; Testing and mask design; Applications and mask design; Time-shared operations; Batch operations; Approach and landing systems; Airborne graphical displays; Solid state device research; Quantum electronics; Materials research; Physics of solids; Microelectronics. GRA

N73-20807# Battelle Columbus Labs., Ohio.
PREPARATION AND PROPERTIES OF RARE-EARTH COMPOUNDS Final Technical Report, 3 Jun. - 31 Dec. 1972
Van E. Wood, Alfred E. Austin, and Kenneth C. Brog 31 Dec. 1972 42 p refs
(Contract DAAH01-70-C-1076; ARPA Order 1588; Battelle Proj. G-0550)
(AD-754775) Avail: NTIS CSCL 20/12

The principal portion of the present report consists of a survey of proposed applications of materials having both magnetic and ferroelectric ordering and/or displaying magnetoelectric coupling effects, together with an assessment of the extent to which any of these applications is feasible using presently known materials. Novel, and in some ways superior, devices of the signal-processing type (such as amplitude or phase modulators) operating at frequencies from microwave to visible are possible in principle, although considerable further experimental work is necessary before it can even be shown that effective specific devices can be designed. Magnetoelectric memory devices do not at present seem very feasible. A brief survey of other work on this program is also included. Author (GRA)

N73-20808# Cambridge Univ. (England). Dept. of Physics.
APPLICATIONS OF MANY-BODY THEORY TO SUPER-

FLUIDS, METALS AND MOLECULES Final Scientific Report, 1 Oct. 1968 - 31 Oct. 1972
Phillip W. Anderson 30 Nov. 1972 6 p refs
(Contract F61052-68-C-0049; AF Proj. 9761)
(AD-754961; AFOSR-73-0021TR) Avail: NTIS CSCL 20/12

The major scientific achievements that have resulted from the contract are briefly outlined. These include significant progress in the understanding of the Kondo effect, the magnetic behavior of less dilute alloys, fundamental studies of magnetism in metals, quantum chemistry of pseudopotential methods, amorphous materials, and miscellaneous many-body problems. A list of the primary papers is included. Author (GRA)

N73-20809# Union Carbide Corp., San Diego, Calif. Crystal Products Dept.
YTTRIUM VANADATE: POLARIZER MATERIALS Interim Technical Report, 1 Oct. 1971 - 30 Apr. 1972
G. A. Keig and H. G. McKnight Nov. 1972 34 p refs
(Contract DAAB07-72-C-0022)
(AD-754650; ECOM-0022-1) Avail: NTIS CSCL 20/2

During the first quarter the crucible and furnace for carrying out crystal growth have been designed and tested. Some initial runs were made to test the concept of maintaining melt stoichiometry by forming it within a sealed crucible. These runs were hindered by weld problems associated with the alloying of Iridium with Vanadium metal formed by the reduction of the YVO4 melt. Changes in welding techniques and furnace design will be made to alleviate this problem. Author (GRA)

N73-20810# Watervliet Arsenal, N.Y.
STEADY STATE CRACK PROPAGATION IN ORTHOTROPIC MEDIA
Robert L. Ryan Nov. 1972 22 p refs
(DA Proj. 1T0-61101-A-91A)
(AD-754529; WVT-7261) Avail: NTIS CSCL 20/12

The problem of a semi-infinite crack propagating at constant speed in an orthotropic solid is considered, and the solution is obtained by use of Riemann-Hilbert theory. Asymptotic forms of the stress field in the neighborhood of the crack tip are determined, and are found to be similar to those for the corresponding isotropic problem. Author (GRA)

N73-20811# Sigmatron, Inc., Santa Barbara, Calif.
ELECTROLUMINESCENT THIN FILM RESEARCH Final Report, Mar. 1964 - May 1970
Edwin J. Soxman and Richard D. Ketchpel 15 Jul. 1972 161 p refs
(Contracts Nonr-4509(00); N00014-72-C-0129)
(AD-754781; Janair-720903; EL-7) Avail: NTIS CSCL 09/5

Vacuum-deposited, light emitting films of zinc sulphide were investigated for use in airborne electronic displays. A very high contrast display structure was evolved through use of a transparent emitter film with a contiguous black backing which exhibited a diffuse reflectivity of less than 0.5 percent. Thus moderate display brightness levels (15 ft-L) with long-life characteristics are made practical for use in bright conditions. Times to half-brightness in excess of 4000 hours were measured. This represents several orders of magnitude improvement over the state of the art. With nominal voltage reset, operational life in excess of 14,000 hours resulted. A recently developed pulse-resonant mode driver is described which can efficiently drive the light emitting film to more than 30 ft-L brightness under 1-percent duty cycle using 12 volts dc. Operating characteristics of the light emitting film are described, as well as various operational formats (5 x 7 dot matrix, seven-segment numeric, bar graphs, aircraft situation display).
Author (GRA)

N73-20812# Texas Instruments, Inc., Dallas.
INVESTIGATION OF RADIATION-INDUCED DEFECTS IN SILICON p-n JUNCTIONS Final Report, 1 May 1971 - 31 Aug. 1972
Martin G. Buehler 1 Sep. 1972 65 p refs
(Contract F19628-71-C-0192; AF Proj. 6096)
(AD-754905; TI-03-72-106; AFCRL-72-0578) Avail: NTIS CSCL 20/12

The intent investigation characterizes electron-and neutron-induced defects in silicon pn junctions. Both p(-)n and n(-)p junctions were fabricated in various (111) silicon substrates which included homogeneous, SiCl4 epitaxial, and SiH4 epitaxial material. Defects were characterized between liquid nitrogen and room temperatures, using thermally stimulated junction measurements. Author (GRA)

N73-20813# North American Aviation, Inc., Anaheim, Calif. Electronics Group.
EPITAXIAL FILM GROWTH OF BUBBLE DOMAIN MATERIALS Final Technical Report, 1 Nov. 1970 - 30 Jun. 1972
D. M. Heinz and P. J. Besser Aug. 1972 40 p refs
(Contract F33615-71-C-1055; AF Proj. 7371)
(AD-754958; C70-1431.20/501; AFML-TR-72-167) Avail: NTIS CSCL 20/2

The program's objective is to improve the compatibility between substrates and films of epitaxially grown magnetic bubble domain materials. The introductory section of this report contains a discussion of the means by which the requirements for the existence of cylindrical magnetic domains may be met in epitaxial films grown by chemical vapor deposition. The experimental section deals with substrate crystal growth and wafer preparation; chemical vapor deposition and heat treatment of epitaxial films. Techniques for characterizing magnetic bubble domain films are reviewed and properties of gallium-substituted erbium iron garnet films are discussed. Preparation and properties of polycrystalline ceramic samples of substituted ytterbium iron garnet are presented. Author (GRA)

N73-20814# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
THE CHEMICAL AND PHYSICAL NATURE OF SURFACES
R. M. Latanision Dec. 1972 27 p refs
(Contract N00014-70-C-0255; DAAF03-72-C-0074; NR Proj. 036-087)
(AD-754453; RIAS-TR-72-22C) Avail: NTIS CSCL 20/12

Certain aspects of the surface chemistry and physics of various inorganic solids - crystalline metals and ceramics and amorphous silicate glasses - are examined in order to illustrate that the surfaces of such solids are likely to be structurally, chemically and electronically distinct from the bulk of the solid. Finally, attention is focused on the application of surface science to certain areas of technology - metal cutting, ceramic machining and other fields of interest. Author (GRA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N73-20815# Naval Air Engineering Center, Philadelphia, Pa. Ground Support Equipment Dept.
GROUND SUPPORT EQUIPMENT: LOW POLLUTANT FUELS Final Report, Sep. 1971 - Aug. 1972
Thomas Dale Weikel Sep. 1972 33 p refs
(AD-755151; NAEC-GSED-59) Avail: NTIS CSCL 21/4

Alternate fuels, with an emphasis on liquefied natural gas are briefly reviewed for feasibility of use in aircraft ground support equipment to reduce air pollution. Electricity, steam, and Wankel engines were also investigated. It was concluded that the most practical system is the use of liquefied petroleum gas and catalytic converters on present gasoline engine support equipment. Author (GRA)

N73-20816# Stanford Research Inst., Menlo Park, Calif.
THE CHEMISTRY OF FUEL DEPOSITS AND THEIR PRECURSORS
Frank R. Mayo, Norman A. Kirshen, Harold Richardson, and Roger S. Stringham Dec. 1972 44 p refs
(Contract N00019-72-C-0161; SRI Proj. PYU-1681)
(AD-754459) Avail: NTIS CSCL 21/4

The objective of the work described was to determine the chemistry of deposit formation in jet turbine fuel systems. This involved the determination of the nature and method of formation of deposit precursors that should have higher molecular weights

and polarities than the fuels. Three approaches have been tried: Oxidations of refluxing n-decane at 155C; Comparison of distillation residues of a standard fuel; and Removal of higher molecular weight products from other oxidation products by precipitation from pentane at -78C. The present status of the jet fuel deposit problem is summarized. GRA

N73-20817# Utah Univ., Salt Lake City.
THE CHEMISTRY AND MECHANICS OF COMBUSTION WITH APPLICATION TO ROCKET ENGINE SYSTEMS
M. L. Williams, L. K. Isaacson, C. F. Thompson, L. F. Moon, and R. J. Zeamer Oct. 1972 40 p refs
(Contract F44620-68-C-0022; AF Proj. 7921)
(AD-754827; UTEC-TH-72-153) Avail: NTIS CSCL 21/9

The purpose of this program was to study the interdependence of combustion processes and the physico-mechanical behavior of solid fuel materials within the context of a rocket engine system. A major goal was to develop a quantitative understanding of molecular structure, which affects both combustion and mechanical behavior. The propellant fuel and associated inert components were treated as a materials system--from processing to a determination of the constitutive equation needed to assess structural integrity and failure under various environmental and loading conditions. The research results of the project are summarized. GRA

N73-20818# Picatinny Arsenal, Dover, N.J.
APPLICATION OF THE VARIABLE ENERGY BLAST WAVE THEORY TO LIQUID MONOPROPELLANT IGNITION BY SHOCK WAVES
E. K. Dabora Dec. 1972 29 p refs
(DA Proj. 1T5-62603-A-559)
(AD-754525; PA-TR-4356) Avail: NTIS CSCL 21/9

A brief review of the literature on blast wave theory is conducted. Special attention is devoted to the variable energy blast wave because of its possible applicability to two-phase detonation phenomena and the ignition of liquid monopropellants by shock waves. Author (GRA)

N73-20819# Battelle Columbus Labs., Ohio.
A BRIEF OVERVIEW OF THE ENERGY REQUIREMENTS OF THE DEPARTMENT OF DEFENSE Final Report
R. W. Sullivan, F. A. Creswick, D. E. Erb, M. S. Farkas, and D. D. Moore Aug. 1972 137 p refs Sponsored in part by ARPA, Arlington, Va.
(Contract DAAH01-72-C-0982)
(AD-754824) Avail: NTIS CSCL 21/4

The report documents the results of a brief program to review the magnitude and nature of the energy requirements of the Department of Defense (DoD) and to identify research and development activities or other actions which should be undertaken by the DoD in order to minimize or ameliorate its energy-related problems. Some of the topics include the following: Energy resources (coal, oil, natural gas, uranium, fusion energy, hydrogen energy); Energy consumption and projections for future requirements; Energy problems; and Specific recommendations (Develop domestic sources of substitute liquid petroleum fuel from oil shale and coal, improve the efficiency of piston and turbine engines, develop strategies for military use of hydrogen as an alternate energy source). GRA

N73-20820# Mitre Corp., McLean, Va.
ENERGY, RESOURCES AND THE ENVIRONMENT
Charles A. Zraket 24 Oct. 1972 40 p refs Revised
(PB-213031; MITRE-72-180-Rev-2) Avail: NTIS HC $3.75 CSCL 21D

A substantive summary of the eight symposia sponsored by MITRE on the interrelationships of energy, resources and the environment during the period July 1971 to July 1972 is presented. Author (GRA)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N73-20821*# Princeton Univ., N.J. Aerospace Systems Lab.
RELIABILITY MODEL OF A MONOPROPELLANT AUXILIARY PROPULSION SYSTEM
Joel S. Greenberg 25 Jun. 1971 68 p refs Sponsored in part by AEC
(Contract NSR-31-001-150)
(NASA-CR-131400; AMS-997) Avail: NTIS HC $5.50 CSCL 21H

A mathematical model and associated computer code has been developed which computes the reliability of a monopropellant blowdown hydrazine spacecraft auxiliary propulsion system as a function of time. The propulsion system is used to adjust or modify the spacecraft orbit over an extended period of time. The multiple orbit corrections are the multiple objectives which the auxiliary propulsion system is designed to achieve. Thus the reliability model computes the probability of successfully accomplishing each of the desired orbit corrections. To accomplish this, the reliability model interfaces with a computer code that models the performance of a blowdown (unregulated) monopropellant auxiliary propulsion system. The computer code acts as a performance model and as such gives an accurate time history of the system operating parameters. The basic timing and status information is passed on to and utilized by the reliability model which establishes the probability of successfully accomplishing the orbit corrections. Author

N73-20822# Messerschmitt-Boelkow G.m.b.H., Ottobrunn (West Germany).
LIQUID PROPULSION TRANSFER AND INJECTION SYSTEM INTO GEOSTATIONARY ORBIT FOR EUROPA 3: LIMOS Final Report
Dec. 1971 106 p Sponsored by ELDO
(URV-47(71)) Avail: NTIS HC $7.50

The mission analysis and design concept of the liquid propulsion transfer and injection system for Europa 3 are discussed, for geostationary and interplanetary missions. The development and cost planning of the system models and unit production are also considered. J.A.M.

N73-20823*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AERODYNAMIC PERFORMANCE OF A CORE-ENGINE TURBINE STATOR VANE TESTED IN A TWO-DIMENSIONAL CASCADE OF 10 VANES AND IN A SINGLE VANE TUNNEL
Roy G. Stabe and John F. Kline Washington Mar. 1973 16 p
(NASA-TM-X-2766; E-7293) Avail: NTIS HC $3.00 CSCL 21E

A turbine stator vane was tested in a two-dimensional cascade of 10 vanes and in a single-vane tunnel. The single-vane tunnel was a cold air version of a tunnel which will be used for high temperature heat transfer testing of cooled turbine vanes. The purpose of the investigation was to determine if the flow conditions in the single-vane tunnel were sufficiently similar to those of a 10-vane cascade to permit meaningful heat transfer testing. The vane was tested over a range of ideal exit critical velocity ratios. The principal measurements were vane surface static pressure and cross-channel surveys of exit static pressure, total pressure, and flow angle. A brief description of the test vane and tunnels is included. The results of the exit surveys, the vane surface pressure distributions, and overall performance in terms of flow and loss for the two test configurations are compared. Author

N73-20824*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR ELECTRIC PROPULSION THRUST SUBSYSTEM DEVELOPMENT
T. D. Masek 15 Mar. 1973 96 p refs
(Contract NAS7-100)

(NASA-CR-131360; JPL-TR-32-1579) Avail: NTIS HC $7.00 CSCL 21C

The Solar Electric Propulsion System developed under this program was designed to demonstrate all the thrust subsystem functions needed on an unmanned planetary vehicle. The demonstration included operation of the basic elements, power matching input and output voltage regulation, three-axis thrust vector control, subsystem automatic control including failure detection and correction capability (using a PDP-11 computer), operation of critical elements in thermal-vacuum-, zero-gravity-type propellant storage, and data outputs from all subsystem elements. The subsystem elements, functions, unique features, and test setup are described. General features and capabilities of the test-support data system are also presented. The test program culminated in a 1500-h computer-controlled, system-functional demonstration. This included simultaneous operation of two thruster/power conditioner sets. The results of this testing phase satisfied all the program goals. Author

N73-20825# Magnavox Co., Fort Wayne, Ind. Government and Industrial Group.

JET ENGINE BURN THROUGH INVESTIGATION. VOLUME 1: SONIC ANALYSIS Final Report, Jun. - Sep. 1972

Richard W. Schumacker Mar. 1973 81 p refs
(Contract DOT-FAT2-575)
(FAA-RD-72-149-Vol-1) Avail: NTIS HC $6.25

A sonic analysis of jet engine burn-through was conducted to determine the acoustic characteristics of simulated failures. Two types of jet engines were modified to simulate the burn-through failures. Magnetic tape recordings of the modified engines were made to determine: (1) the extent of the acoustic spectrum, (2) the relationship of engine speed to failure related sound pressure levels and acoustic spectrum, (3) the effect of sensor location on burn-through detection, and (4) the characteristic acoustic spectra at burn-through. The data were analyzed by real time spectrum analysis and mean square techniques. It was determined that acoustic detection of burn-through failure is feasible. Author

N73-20826*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EXHAUST NOISES IN JET ENGINES Patent Application

Ira R. Schwartz, inventor (to NASA) Filed 23 Mar. 1973 25 p
(NASA-Case-ARC-10712-1; US-Patent-Appl-SN-344410) Avail: NTIS HC $3.25 CSCL 21E

This invention relates generally to that class of motive power sources commonly referred to as jet engines and more particularly to improvements to such engines for reducing the noise generated by the turbulent intermixing of the exhaust gases with the ambient atmosphere. NASA

N73-20827*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

REACTION CONTROL SYSTEM HELIUM PRESSURE REGULATOR FILTER FAILURE Apollo 16 Mission Anomaly Report No. 6

Dec. 1972 9 p
(NASA-TM-X-69131; MSC-07640) Avail: NTIS HC$3.00 CSCL 21E

The failure analysis of the command module reaction control system helium pressure regulators revealed that the filter element end caps were bulged by the helium pressure surge during activation. Some end caps may bulge and also some wire separation may occur during command module reaction control system activations; however, system performance should not be affected. The reaction control system design is acceptable and no change in hardware, system, or activation procedures is required. A.L.

N73-20828*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

REVIEW OF KAUFMAN THRUSTER DEVELOPMENT AT THE LEWIS RESEARCH CENTER, 1973

W. R. Kerslake Apr. 1973 7 p refs Presented at Elec. Propulsion Conf., Culham, England, 10-12 Apr. 1973; Sponsored by Inst. of Elec. Engr.
(NASA-TM-X-68202) Avail: NTIS HC $3.00 CSCL 21C

Two thruster sizes are studied. One, a small 5-cm or 8-cm size is for spacecraft station keeping. The other, 30-cm (130 mN thrust), is for a thruster array to do primary solar electric propulsion. A 5-cm thruster (1.8 mN) has recently completed 9715 hr of life testing. Use of dished grids in the 30-cm thruster has increased beam current from 2 to 5 A. The total thrust system mass is compared for present small thrusters at different operating conditions for station keeping of synchronous satellites. Author

N73-20829*# New York Univ., N.Y.

SCRAMJET FUEL INJECTOR DESIGN PARAMETERS AND CONSIDERATIONS: DEVELOPMENT OF A TWO-DIMENSIONAL TANGENTIAL FUEL INJECTOR WITH CONSTANT PRESSURE AT THE FLAME

Anthony M. Agnone Sep. 1972 104 p refs
(Grant NGR-33-016-131)
(NASA-CR-112302; NYU-AA-72-25) Avail: NTIS HC $7.25 CSCL 21A

The factors affecting a tangential fuel injector design for scramjet operation are reviewed and their effect on the efficiency of the supersonic combustion process is evaluated using both experimental data and theoretical predictions. A description of the physical problem of supersonic combustion and method of analysis is followed by a presentation and evaluation of some standard and exotic types of fuel injectors. Engineering fuel injector design criteria and hydrogen ignition schemes are presented along with a cursory review of available experimental data. A two-dimensional tangential fuel injector design is developed using analyses as a guide in evaluating the effects on the combustion process of various initial and boundary conditions including splitter plate thickness, injector wall temperature, pressure gradients, etc. The fuel injector wall geometry is shaped so as to maintain approximately constant pressure at the flame as required by a cycle analysis. A viscous characteristics program which accounts for lateral as well as axial pressure variations due to the mixing and combustion process is used in determining the wall geometry. Author

N73-20830# Army Foreign Science and Technology Center, Charlottesville, Va.

GAS TURBINE INSTALLATIONS FOR HYDROFOILS

P. A. Bulygin 7 Dec. 1972 204 p Transl. into ENGLISH of the book "Gazoturbinnye Ustanovki Sudov na Podvodnykh Krylyakh" Leningrad, Sudostr. Publ. House, 1971 192 p
(AD-753890; FSTC-HT-23-1375-72) Avail: NTIS CSCL 13/10

The design and operating features of gas turbine installations for hydrofoils are reviewed. The different ways in which aviation gas turbine engines designed for operation with marine propellers can be converted are explained. The materials from the design and operation of the propulsion plants for the first Soviet gas turbine driven hydrofoil, Burevestnik, and for other ships, were used in the writing of the book. Author (GRA)

N73-20831# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

METHOD OF CALCULATING A TWO-PHASE EJECTOR

M. E. Deich, G. V. Tsiklauri, Yu. F. Kalinin, and N. A. Dikii 11 Dec. 1972 21 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. i Transp. (Moscow), no. 2, 1971 p 123-129
(AD-754051; FTD-MT-24-1495-72) Avail: NTIS CSCL 21/5

A method of designing a two phase two component injector is presented on the basis of an experimental study. The operation of the injector is compared under subsonic and supersonic conditions. It is shown that for fixed conditions (nozzle geometry and initial parameters) there is a certain optimum area of the throat of the exit cone where the highest back pressure is reached. Author (GRA)

N73-20832# Naval Air Propulsion Test Center, Trenton, N.J. Propulsion Technology and Project Engineering Dept.

J52-P-8 ENGINE COMPRESSOR STALL MARGIN ACCEPTANCE TESTS

Joseph F. Boytos, William A. Rich, and Richard T. Lazarick Nov. 1972 32 p refs
(AD-755152; NAPTC-PE-10) Avail: NTIS CSCL 21/5

Two J52-P-8 engines were tested in a sea level cell to

develop a method for determining acceptable compressor stall margin. One engine had good stall margin; the other was a stall-reject based on ground static Bodie tests in an A-4 aircraft. Tests were limited to steady-state calibrations, inlet distortion, and power extraction; accelerations, decelerations, and bodies with standard and enriched fuel schedules. Both engines had acceptable uninstalled steady-state and transient stall margin and steady state distorted inlet stall margin. Author (GRA)

N73-20833# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md. Chemical Propulsion Information Agency.
HYBRID ROCKET INTERNAL BALLISTICS
David W. Netzer and Warren E. Bae, ed. Jan. 1972 53 p refs
(Contract N00017-72-C-4401)
(AD-754769; CPIA-Pub-222) Avail: NTIS CSCL 21/8

The report presents a summary of hybrid rocket internal ballistics. Discussion is primarily concerned with the current theory that is based on a heat transfer limited model. Areas of application, major limitations, kinetic effects, and controversial aspects are briefly discussed. Areas are identified that require additional analytical and/or experimental investigation. The review was completed in June 1971, and does not include bibliographic material after that date. Author (GRA)

N73-20834# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL RESEARCH OF THE EFFECT OF THE ANGLE OF ROTATION OF STATOR BLADES ON THE OPERATION OF A SMALL SIZE TURBINE STAGE
A. G. Kurzon and Yu. V. Robinshtein 10 Nov. 1972 17 p refs Transl. into ENGLISH from Tr. Isentr. Nauchn.-Issled. Inst. Morsk. Flota (Leningrad), no. 126, 1970 p 19-26
(AD-754683; FTD-MT-24-1478-72) Avail: NTIS CSCL 21/5

The report gives the results of an investigation of three small sized turbine stages with various angles of fixation of the nozzle vanes. Factors are examined which influence the efficiency of the stage during the rotation of the nozzle vanes. A comparison is made with data of similar experiments on stages of large size. Author (GRA)

N73-20835# Air Force Armament Lab., Eglin AFB, Fla.
RAMJET ENGINE FUEL INJECTION STUDIES Technical Report, 5 Oct. 1970 - 15 Sep. 1971
John T. Hojnack Nov. 1972 44 p refs
(AF Proj. 3012)
(AD-754852; AFAPL-TR-72-76) Avail: NTIS CSCL 21/5

The purpose of the investigation was to develop empirical methods for designing a fuel injection system applicable to sudden expansion burners using a coaxial inlet. An integral rocket/ramjet missile may utilize this type of fuel system. The primary objective of a liquid fuel injection system is to provide the combustion chamber with the proper amount of fuel in a pattern that will result in efficient combustion over the flight path of the missile. The relative amounts of fuel and air at the flameholding region are important in determining the efficiency of combustion. From the local fuel/air ratio relationship, a family of curves was plotted, which are functions of downstream distance and overall fuel/air ratio. With these curves, the injector was placed at the appropriate distance from the flameholding region to obtain stoichiometric conditions at that region. Subsequent tests using the AFAPL Ramjet Burner Thrust Stand Facility verified that efficient combustion was achieved. Author (GRA)

N73-20836# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
SPECIFIC CHARGE AND MASS FLOW DISTRIBUTION IN A COLLOID BEAM Final Report
Jerrell M. Turner Nov. 1972 73 p refs
(AF Proj. 3141)
(AD-754902; AFAPL-TR-72-81) Avail: NTIS CSCL 21/3

An experimental program established that a multiple needed colloid thruster produces a beam with anisotropic current, specific charge, and mass flow distributions as a function of beam half-angle. Data reduction and analysis indicated that the assumptions of beam isotropy yields valid relative performance but the absolute value of performance determined from the time-of-flight spectrometer is questionable. A segmented time-of-flight collector, consisting of ten electrically isolated rings which could be connected to simulate a total collector, was the primary diagnostic tool. For thrust, specific impulse, and efficiency, results from the segmented and total collector differed by up to 30%. Even larger differences were observed in the case of mass flow. By moving the collector, it was found that the distance between the source and time-of-flight collector has a significant effect on specific charge and current. Author (GRA)

N73-20837# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CARBON DEPOSITS IN JET ENGINES
K. K. Papok, V. A. Piskunov, and P. G. Yurenya 22 Sep. 1972 180 p refs Transl. into ENGLISH of the mono. "Nagary v Reaktivnykh Dvigatelyakh" Moscow, Izd-vo Transport, 1971 p 1-110
(AF Proj. 7343)
(AD-754607; FTD-MT-24-1946-71) Avail: NTIS CSCL 21/5

In the book the questions of the formation of carbon deposits and its influence on the reliability, efficiency, and service life of aviation jet engines are examined. Soviet and foreign materials about the properties of carbon deposits, conditions of their formation, and the influence of various factors on the formation of deposits are generalized. In the book there is comprehensive examination of the influence of fuels of various chemical and fractional composition and also the varying kinds of additives on the formation of deposits. Basic methods and means are stated for the evaluation of the deposit forming properties of aviation fuels and oils. Author (GRA)

N73-20838# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
RAMJET TECHNOLOGY. CHAPTER 9: COMBUSTOR DESIGN
E. A. Bunt, G. S. McMurray, and G. L. Dugger Apr. 1972 139 p refs
(Contract N00017-72-C-4401)
(PB-212691; APL-TG-610-9) Avail: NTIS HC $3.00 CSCL 21E

The effects of numerous variables on combustion stability and efficiency are considered in order to provide practical guidelines for the design of both baffle- and can-type combustion chambers for ramjet engines. This TG is one of a series of reports representing individual chapters of a proposed book entitled Ramjet Technology. Author (GRA)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N73-20839*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
K ALPHA LINE EMISSION DURING SOLAR X-RAY BURSTS
K. J. H. Phillips and W. M. Neupert Mar. 1973 27 p refs Submitted for publication
(NASA-TM-X-66210; X-682-73-81) Avail: NTIS HC $3.50 CSCL 03B

Calculations of K alpha line emission from S, Ar, Ca and Fe are presented. It is reported that on the basis of data for hard X-ray bursts, the flux during most impulsive, non-thermal events is likely to be weak, though for a few strong bursts, a flux of approximately 100 photons/cm/s may be expected. The amount of S K alpha emission particularly is sensitively dependent on the value of the lower energy bound of the non-thermal electron distribution, offering a possible means of determining this. Thermal K alpha emission is only significant for Fe ions. The calculated thermal K alpha radiation is much less than that observed during an intense soft X-ray burst. It is concluded that a detailed temperature structure for the emission source is required in order to explain the discrepancy. Author

N73-20840*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ESTIMATES OF TRAPPED RADIATION ENCOUNTERED ON LOW-THRUST TRAJECTORIES THROUGH THE VAN ALLEN BELTS
Irving M. Karp Washington Apr. 1973 17 p refs
(NASA-TM-X-2777; E-7341) Avail: NTIS HC $3.00 CSCL 03B

Estimates were made of the number of trapped protons and electrons encountered by vehicles on low-thrust trajectories through the Van Allen belts. The estimates serve as a first step in assessing whether these radiations present a problem to on-board sensitive components and payload. The integrated proton spectra and electron spectra are presented for the case of a trajectory described by a vehicle with a constant-thrust acceleration A sub c equal to 0.001 meter/sq sec. This value of acceleration corresponds to a trip time of about 54 days from low earth orbit to synchronous orbit. It is shown that the time spent in the belts and hence the radiation encountered vary nearly inversely with the value of thrust acceleration. Thus, the integrated spectral values presented for the case of A sub c = 0.001 meter/sq sec can be generalized for any other value of thrust acceleration by multiplying them by the factor 0.001/A sub c. Author

N73-20841# Aerospace Corp., El Segundo, Calif.
SPECTRAL DEVELOPMENT OF SOLAR X-RAY BURST OBSERVED ON OSO-7
David L. McKenzie, Dayton W. Datlowe (Calif. Univ., San Diego), and Laurence E. Peterson (Calif. Univ., San Diego) 10 Nov. 1972 21 p refs
(Contracts NAS5-11081; F04701-72-C-0073)
(NASA-CR-131245; AD-753393; TR-0073(9260-02)-2; SAMSO-TR-72-28821) Avail: NTIS HC $3.25 CSCL 03/2

The authors have made computer fits to proportional counter soft X-ray data and scintillation counter hard X-ray data for a small hard X-ray burst at UT 0519 on November 16, 1971. The energy content of the thermal plasma increased in conjunction with a hard X-ray burst of 60-second duration which entirely preceded the 5-keV X-ray maximum. If X-rays arise by thick target bremsstrahlung, the observed suprathermal electrons have sufficient energy to heat the thermally emitting plasma. In the thin target case, the collisional energy transfer from nonthermal electrons suffices only if the power law electron spectrum is extrapolated below 10 keV or the ambient plasma density exceeds 4 x 10 to the 10th power/cc. Author (GRA)

N73-20842*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MODEL OF THE STARFISH FLUX IN THE INNER RADIATION ZONE
M. J. Teague (KMS Technol. Center) and E. G. Stassinopoulos Dec. 1972 66 p refs
(NASA-TM-X-66211; X-601-72-487) Avail: NTIS HC $5.50 CSCL 03B

A model of the Starfish electrons injected into the radiation belt in July 1962 was determined for epoch September 1964. This model distinguishes between artificial and natural electrons and provides the artificial unidirectional electron flux as a function of equatorial pitch angle, energy, and L value. The model is based primarily upon data from the OGO-1, OGO-3, OGO-5, 1963-38C, and the OV3-3 satellites. Decay times for the Starfish electrons are given as a function of energy and L value. These decay times represent the best compromise between a number of independently determined values. The times at which the artificial Starfish flux component had become insignificant in comparison to the natural flux component are determined as functions of energy and L value. These times are determined by two separate methods, and averaged values are presented. It is shown that Starfish electrons, by the present time, have become insignificant for all energies and L values. Author

N73-20843*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CAS A X-RAY SPECTRUM: EVIDENCE FOR IRON LINE EMISSION
P. J. Serlemitsos, E. A. Boldt, S. S. Holt, R. Ramaty, and A. F. Brisken (Md. Univ.) Mar. 1973 18 p refs
(NASA-TM-X-66216; X-661-73-79) Avail: NTIS HC $3.00 CSCL 03B

A sensitive measurement by rocket borne detectors of the X-ray flux from Cas A has revealed a steep continuum and a broad spectral feature in the region where line radiation from iron nuclei would be expected. The flux in this feature is .0122 plus or minus .0017 photons/sq cm/s: the total energy flux from 2 to 10 KeV is 1.02 x 10 to the minus 9th power ergs/sq cm/s. The presence of broad iron lines is consistent with a model in which approximately 13 MeV/nucleon iron nuclei charge exchange with surrounding interstellar oxygen and other heavy atoms. The model suggests that a substantial fraction of the energy from the outburst has gone into low energy cosmic rays which produce the observed HII region surrounding the remnant. Author

N73-20844*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE INITIAL STAGE OF DEVELOPMENT OF TYPE 4 RADIO BURSTS AND THE RELATION TO EXPANDING MAGNETIC BOTTLES
Kunitomo Sakurai Mar. 1973 21 p refs
(NASA-TM-X-66217; X-693-73-103) Avail: NTIS HC $3.25 CSCL 03B

Using observed data for wide-band type IV solar radio bursts, the onset time differences between the microwave and metric frequencies and the peak flux intensities of the metric component were analyzed as a function of the longitudinal position of associated flares on the solar disk. It is shown that this time difference is dependent on the position of associated flares and that the peak flux intensity reaches maximum when a flare occurs in the region 10 to 40 deg west of the central meridian of the solar disk. These results are explained by taking into account the eastward expansion of magnetic bottles which trap mildly relativistic electrons responsible for type IV bursts. Discussion is also made of the relation between these magnetic bottles and shock waves which excite type II radio bursts. Author

N73-20845# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
HEIGHT DISTRIBUTION AND DIRECTIONALITY OF 2-12 ANGSTROM X-RAY FLARE EMISSION IN THE SOLAR ATMOSPHERE Progress Report
Charles P. Catalano and James A. VanAllen Dec. 1972 44 p refs
(Contract N00014-68-A-0196-0003)
(AD-754772; U-of-Iowa-72-39) Avail: NTIS CSCL 03/2

The emission of soft X-rays (2 - 12 A) in solar flares has been studied in a new way by using simultaneous observations by two spacecraft near the earth (Explorers 33 and 35) and another at a markedly different heliocentric longitude (Mariner V) during the 117-day period 1967 July 28 to November 21. Detailed intensity vs time observations on 607 separate flares were obtained. The principal findings are discussed in the report. GRA

N73-20089* Scientific Translation Service, Santa Barbara, Calif.
METHOD OF MEASURING THE COMPOSITION AND INTENSITY OF THE HEAVY COMPONENT OF COSMIC RADIATION
M. D. Nikitin, V. P. Perelygin, and S. P. Tretyakova *In its* Probl. of Space Biol., Vol. 14 Feb. 1973 p 591-601 refs
(For availability see N73-20054 11-04)
CSCL 03B

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N73-20846*# Ohio State Univ. Research Foundation, Columbus.
AN INVESTIGATION TO IMPROVE SELENODETIC CONTROL ON THE LUNAR LIMB UTILIZING APOLLO 15

TRANS-EARTH PHOTOGRAPHY Interim Report
Wyndham Riotte Jun. 1972 118 p refs
(Contract NAS9-9695)
(NASA-CR-131264; Rept-176; IR-7) Avail: NTIS HC $8.00 CSCL 03B

A study is made using actual metric photography taken by Apollo 15 after the trans-earth injection when the spacecraft left the lunar orbit. After measurements on 12 frames were reduced for 11 known control and unknown points on the eastern limb, a least squares adjustment program provided the simultaneous solution for the selected points. The results indicate an improvement in selenodetic control may be achieved over a limited portion of the lunar limb; however, the solution could be further improved by strengthening the geometry of intersecting rays through additional observations of the same area using film from the succeeding Apollo missions. Author

N73-20847*# GCA Corp., Bedford, Mass. Technology Div.
A STUDY OF PLANETARY METEOROLOGY Final Report
George Ohring Jan. 1973 52 p refs
(Contract NASw-2221)
(NASA-CR-131266; GGA-TR-73-1-N) Avail: NTIS HC $4.75 CSCL 03B

Inversion techniques are applied to the few earth based observations of the Jovian emission spectrum to obtain directly the profiles of atmospheric temperature and ammonia abundance. The temperature profile is characterized by a definite tropopause region with a temperature of about 115K and a stratospheric region in which the temperature slowly increases with altitude. The derived ammonia profile indicates the presence of a saturated ammonia layer with a base temperature of approximately 140K. The concept is described deducing the temperature and constituent profile of a planetary atmosphere from orbiter measurements of the planet's IR limb radiance profile. Analysis of the weighting functions for the Martian atmosphere indicates that a limb radiance profile in the 15 micron CO2 band can be used to determine the Martian atmospheric temperature profile from 20 to 60 km. Author

N73-20848*# Mathematica, Inc., Princeton, N.J.
SEMINAR PRESENTATION ON THE ECONOMIC EVALUATION OF THE SPACE SHUTTLE SYSTEM Final Report
28 Feb. 1973 23 p refs
(Contract NASw-2384)
(NASA-CR-131421) Avail: NTIS HC $3.25 CSCL 22A

The proceedings of a seminar on the economic aspects of the space shuttle system are presented. Emphasis was placed on the problems of economic analysis of large scale public investments, the state of the art of cost estimation, the statistical data base for estimating costs of new technological systems, and the role of the main economic parameters affecting the results of the analyses. An explanation of the system components of a space program and the present choice of launch vehicles, spacecraft, and instruments was conducted. Author

N73-20849*# Lunar Science Inst., Houston, Tex.
COSPAR, IAU, LSI COLLOQUIUM ON LUNAR DYNAMICS AND OBSERVATIONAL COORDINATE SYSTEMS: REVISED ABSTRACTS
Michael Moutsoulas, ed. Jan. 1973 62 p refs Colloq. held at Houston, Tex., 15 - 17 Jan, 1973
(Contract NSR-09-051-001)
(NASA-CR-131263; LSI-Contrib-135) Avail: NTIS HC $5.25 CSCL 03B

The proceedings of a colloquium on lunar dynamics and observational coordinate systems are presented. Discussions were held on the establishment of a fundamental reference system and on the lunar ephemerides. Abstracts of the subjects discussed at the meeting are submitted. Some of the topics discussed are: (1) coordinates of the Apollo retroreflectors, (2) determination of lunar baselines, (3) numerical series for the variations of lunar coordinates, (4) fundamental craters for establishing a lunar coordinate system, and (5) composite lunar gravity fields. Author

N73-20850*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER MARS 1971 TELEVISION PICTURE CATALOG. VOLUME 2: SEQUENCE DESIGN AND PICTURE COVERAGE
P. E. Koskela, M. R. Helton, L. N. Seeley, and S. J. Zawacki
15 Dec. 1972 622 p refs
(Contract NAS7-100)
(NASA-CR-131416; JPL-TM-33-585-Vol-2) Avail: NTIS HC $33.25 CSCL 03B

A collection of data relating to the Mariner 9 TV picture is presented. The data are arranged to offer speedy identification of what took place during entire science cycles, on individual revolutions, and during individual science links or sequences. Summary tables present the nominal design for each of the major picture-taking cycles, along with the sequences actually taken on each revolution. These tables permit identification at a glance, all TV sequences and the corresponding individual pictures for the first 262 revolutions (primary mission). A list of TV pictures, categorized according to their latitude and longitude, is also provided. Orthographic and/or mercator plots for all pictures, along with pertinent numerical data for their center points are presented. Other tables and plots of interest are also included. This document is based upon data contained in the Supplementary Experiment Data Record (SEDR) files as of 21 August 1972. Author

N73-20851*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
SMITHSONIAN CONTRIBUTIONS TO ASTROPHYSICS
1973 20 p refs
(Contract NSR-09-015-033; Grant NGR-09-015-004)
(NASA-CR-131177) Avail: NTIS MF $0.95; SOD HC $0.45 CSCL 03B

Discrete levels of the beginning height of meteors in streams are discussed in terms of Ceplecha's classification system. This system involves the classification according to meteoroid density of separate streams of meteors. Various meteoroid sources are considered and categorized using this system. For individual titles, see N73-20852 through N73-20853.

N73-20852* Smithsonian Astrophysical Observatory, Cambridge, Mass.
DISCRETE LEVELS OF BEGINNING HEIGHT OF METEORS IN STREAMS
A. F. Cook *In its* Smithsonian Contrib. to Astrophys. 1973 12 p refs (For availability see N73-20851 11-30)
(Contrib-14) CSCL 03B

Consideration is given for 26 streams of meteors classified according to Ceplecha's discrete levels of beginning height, 13 of which are associated with known comets. Comet Biela produced in the Andromedids a double-peaked distribution (Classes A and C). Apparently no known comets produce a stream of Class B. Consideration of Whipple and Stefanik's model of an icy conglomerate nucleus with radioactive heating and redistribution of ice leads to association of Ceplecha's Class C with the residue of the ice-impregnated surface of a cometary nucleus after sublimation of the ices, and of Ceplecha's Class A with the core of a cometary nucleus. Class B meteoroids are then associated with less dense cores of smaller cometary nuclei that have lost their surfaces and are too small to have been observed. It is concluded that the density of Class A meteoroids (1.2 g/cu cm) is so close to that of Type 1 carbonaceous chondrites (2 g/cu cm) as to suggest that the latter come from old cores of very large nuclei of comets, an idea originally proposed by McCrosky and Ceplecha. Author

N73-20853* Smithsonian Astrophysical Observatory, Cambridge, Mass.
YET ANOTHER STREAM SEARCH AMONG 2401 PHOTOGRAPHIC METEORS
A. F. Cook, B.-A. Lindblad, B. G. Marsden, R. E. McCrosky, and A. Posen *In its* Smithsonian Contrib. to Astrophys. 1973 7 p refs (For availability see N73-20851 11-30)
(Contrib-15) CSCL 03B

Two streams previously listed (one of them with a classification on Ceplecha's system in terms of beginning height) by Cook are shown probably not to exist, a possibility already pointed out by Cook. One stream that he questioned was revised as to membership and then classified. Four streams are added to the list and one of these is classified. Previous reports exist for three of these streams, while one is new. The two Piscid streams

of Lindblad and his alpha Triangulid stream are regrouped into two streams, one already called the Andromedids by Cook and the other still called the Piscids; the alpha Triangulids are absorbed into the Andromedids. The Piscids are classified along with the iota Aquarids. The classifications of the Taurids and the Andromedids remain unchanged. Author

N73-20854*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DYNAMIC MASS MODELING AND GEOPHYSICAL ANALYSIS OF LUNAR MARIA BASED ON APOLLO TRACKING DATA
William E. Strange (Computer Sciences Corp.), Mark L. Sandson (Computer Sciences Corp.), and James P. Murphy May 1972 33 p refs Submitted for publication
(NASA-TM-X-65940; X-553-72-148) Avail: NTIS HC $3.75 CSCL 03A

A series of lunar gravity analyses were carried out using unified S-band tracking network data obtained from Apollos 8, 10, 11, 12, 14, and 15. The progress obtained to date is summarized as it relates to the estimation of lunar mass distributions and their geologic interpretation. The analyses reported are of two distinct types. The first type consists of data obtained at two ranges of altitude to estimate the total mass associated with various lunar features employing a point mass assumption. The second type consists of detailed analyses of Apollo 14 tracking data. D.L.G.

N73-20855*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER MARS 1971 PROJECT. VOLUME 1: PROJECT DEVELOPMENT THROUGH LAUNCH AND TRAJECTORY CORRECTION MANEUVER
1 Apr. 1973 85 p refs
(Contract NAS7-100)
(NASA-CR-131268; JPL-TR-32-1550-Vol-1) Avail: NTIS HC $6.25 CSCL 22A

The mission objectives, requirements, and space design for Mariner Mars 1971 are discussed along with the prelaunch and launch operations. The first trajectory correction manuever is also described. F.O.S.

N73-20856*# Linguistic Systems, Inc., Cambridge, Mass.
ON THE NATURE OF THE "BLUE CLEARINGS" ON MARS
V. V. Prokofyeva Washington NASA Mar. 1973 5 p refs Transl. into ENGLISH from Astron. Tsirkuliar Akad. Nauk SSSR (Kazan), no. 720, 18 Sep. 1972 p 4-6
(Contract NASw-2482)
(NASA-TT-F-14820) Avail: NTIS HC $3.00 CSCL 03B

An attempt is made to explain the appearance of dark details (blue clearings) on photographs of Mars, made in the short wave region of the spectrum. The hypothesis proposed is that the appearance of these blue clearings may be connected with the lifting of dust from the planet's surface during intensification of atmospheric circulation. Some support for this hypothesis is offered. Author

N73-20857*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
[RESEARCH IN PARTICLES AND FIELDS IN SPACE] Progress Report, 1 Jul. - 31 Dec. 1972
Paul J. Coleman, Jr. 7 Mar. 1973 49 p refs
(Grant NGL-05-007-004)
(NASA-CR-131269) Avail: NTIS HC $4.50 CSCL 03C

Theoretical and experimental work in charged particle and magnetic field research is reported. Activities center on plasma generation and acceleration, ATS 1 data processing for evaluation of magnetospheric substorms and micropulsations during magnetic disturbances, and the development of solar wind model using Mariner observations. G.G.

N73-20858*# Environmental Research Inst. of Michigan, Ann Arbor.
ANALYSIS OF TEST DATA FILM GENERATED BY THE LUNAR SOUNDER (S-209)
Norman Massey Feb. 1973 22 p
(Contract NAS9-12559)
(NASA-CR-128883) Avail: NTIS HC $3.25 CSCL 03B

The analysis of test films pertaining to the readiness of the Apollo 17 radar equipment is discussed. Emphasis is placed on the evaluation of the lunar sounder equipment. The lunar sounder experiment was to examine the lunar surface at three different radar frequencies of 2 meters, 60 meters, and 20 meters. Test films were made on the lunar sounder system to describe the purpose of the test, to describe the experiments used for analysis, and to provide conclusions reached after analysis. Author

N73-20859*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PIONEER F AND G MISSION TO JUPITER
[1973] 35 p
(NASA-TM-X-69125) Avail: NTIS HC $3.75 CSCL 22A

The Pioneer missions to Jupiter in 1972 and 1973 are described along with the planet Jupiter. The spacecraft, navigation, attitude control, and propulsion are discussed along with the communications and data handling. The objectives of the missions are to map magnetic fields, solar wind, radiation belts and asteroids. F.O.S.

N73-20860# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 296
9 Mar. 1973 72 p refs Transl. into ENGLISH from Russian articles
(JPRS-58437) Avail: NTIS HC $5.75

Abstracts of articles on meteorology, oceanography, upper atmosphere and space research, astronomy, and terrestrial geophysics, covering both science news and formal scientific reports are provided. Published details of Soviet space programs are also included. Author

N73-20861# Lowell Observatory, Flagstaff, Ariz.
LOWELL PROPER MOTIONS 16: PROPER MOTION SURVEY OF THE SOUTHERN HEMISPHERE WITH THE 13-INCH PHOTOGRAPHIC TELESCOPE OF THE LOWELL OBSERVATORY
H. L. Giclas, R. Burnham, Jr., and N. G. Thomas 1 Mar. 1973 28 p refs Repr. from Lowell Obs. Bull. No. 160, v. 7, no. 23, 1 Mar. 1973 p 273-300
Avail: NTIS HC $3.50

A catalog containing data on 691 stars, 63% newly listed, is presented for the Southern Hemisphere. The proper motions, colors, and magnitudes are included for each star. F.O.S.

N73-20862*# Grumman Aerospace Corp., Bethpage, N.Y.
A STUDY OF MODAL COUPLING PROCEDURES FOR THE SPACE SHUTTLE
S. Goldenberg and M. Shapiro [1972] 110 p refs
(Contract NAS1-10635)
(NASA-CR-112252) Avail: NTIS HC $7.50 CSCL 22A

Various procedures for analytically coupling two or more substructures to obtain modal data for the assembly, using data obtained from mode surveys of the individual components are reported. Particular attention was paid to the applicability of the techniques investigated to the space shuttle, with the possible replacement of full scale mode surveys of the shuttle assembly by component mode surveys along with analytical coupling. The coupling procedures were intially verified and evaluated by applying them to analytical check problems. Lumped parameter analysis was used to compute the modal properties of an assembly and its components. The analytical component modes were then coupled, and the results compared with those obtained by direct analysis of the assembly. The two most promising procedures, determined from the accuracy of the results and from the ease of obtaining the required experimental data, were then applied to test data. Author

N73-20863*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 16 MISSION. HOLES IN CANOPY OF MAIN PARACHUTE
Dec. 1972 6 p
(NASA-TM-X-69127; MSC-07641; Rept-5) Avail: NTIS HC $3.00 CSCL 22C

The occurrence of an anomaly during the Apollo 16 flight is discussed. The canopy of one of the recovered main parachutes

had numerous small burn holes. An analysis of events following main parachute deployment which could cause the anomaly is presented. It is concluded that the burn holes in the parachute were the result of oxidizer being expelled when the plus-yaw engines were fired as the spacecraft was in the final phase of descent. Author

N73-20864*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 16 MISSION ANOMALY REPORT NO. 10: REAR STEERING INOPERATIVE
Feb. 1973 6 p
(NASA-TM-X-69124; MSC-07683) Avail: NTIS HC $3.00 CSCL 22C

The report by the Apollo 16 crew that the lunar roving vehicle rear steering was inoperative during the initial drive from the vehicle's deployment site was investigated. The malfunction, and the steering system are described. It is concluded that an open circuit occurred either in the hand controller potentiometer or between the potentiometer wiper and the summing node. F.O.S.

N73-20865*# Grumman Aerospace Corp., Bethpage, N.Y.
PHOTOMETRIC AND POLARIMETRIC PROPERTIES OF THE BRUDERHEIM CHONDRITIC METEORITE
W. G. Egan, J. Veverka (Cornell Univ., Ithaca, N. Y.), M. Noland (Cornell Univ., Ithaca, N. Y.), and T. Hilgeman Mar. 1973 40 p refs Submitted for publication
(Grant NGR-33-010-082)
(NASA-CR-131418; RE-447J) Avail: NTIS HC $4.00 CSCL 03B

Photometric and polarimetric laboratory measurements were made as a function of phase angle in the U(0.36 microns), G(0.54 microns) and R(0.67 microns) bands for 0, 30 and 60 deg incident illumination on four particle size ranges of Bruderheim, an L6 olivine-hypersthene chondritic meteorite. The four particle size ranges were: 0.25-4.76 mm coated with less than 74 microns powder, 74-250 microns, and less than 37 microns. In addition, normal reflectance measurements were made in the spectral range from 0.31 to 1.1 microns. Comparison with astronomical data reveals that none of the asteroids in the main belt for which adequate observations exist can be matched with Bruderheim, which is representative of the most common meteoritic material encountered by the Earth. However, it appears from the polarization and photometry data that the surface of the Apollo asteroid Icarus is consistent with an ordinary chondrite composition. This suggests the possibility that this material, although common in Earth-crossing orbits, is rare as a surface constituent in the main asteroid belt. Author

N73-20866*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EQUATORIAL ELECTROJET SATELLITE AND SURFACE COMPARISON
J. C. Cain, ed. and Ronald E. Sweeney, ed. Dec. 1972 87 p refs A collection of Papers presented to the 4th Intern. Symp. on Equatorial Aeronomy Submitted for publication Sap HC $6.50
(NASA-TM-X-66218; X-645-73-5) Avail: NTIS CSCL 03B

The OGO 4 and 6 (POGO) magnetic field results for the equatorial electrojet indicate that while the present models are approximately correct, the possibility of a westward component must be incorporated. The scatter diagrams of POGO amplitudes and surface data show a correlation. The ratios between the amplitudes estimated from surface data and those at 400 km altitude are as follows: India 5 to 8, East Africa (Addis Ababa) 4, Central Africa 3, West Africa (Nigeria) 3, South America (Huancayo) 5, and Philippines 5. The variation in the ratio is due to the conductivity structure of the earth in various zones. Author

N73-20867# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 297
29 Mar. 1973 83 p refs Transl. into ENGLISH from various Soviet bloc periodicals
(JPRS-58609) Avail: NTIS HC $6.25

Translations and abstracts of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports are presented. Published details of Soviet space spectaculars are included. Author

N73-20868# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYSTEM FOR PRECISION RANGING OF METEOR TRAILS
R. P. Chebotarev and V. N. Sidorin 19 Jan. 1973 15 p refs Transl. into ENGLISH from Byull. Akad. Nauk Tadzhik. SSR, Inst. Astrofiz. (Dushanbe), no. 55, 1970 p 29-33
(AF Proj. 4506)
(AD-754623; FTD-HT-23-1719-72) Avail: NTIS CSCL 04/1

The article discusses the problem of precision radar ranging of meteor trails and possible ranging techniques. It discusses in detail the system of circular scanning and of brightness indicators which give ranging with an accuracy of plus or minus 50m and are unique to meteor radar. The results of the experiment and the actual operation of the system are given. Author (GRA)

N73-20869# Naval Research Lab., Washington, D.C. Mathematics and Information Sciences Div.
HIGHER ORDER THEORY FOR LONG-TERM BEHAVIOR OF EARTH AND LUNAR ORBITERS Final Report on Phase One
Bernard Kaufman and Robert Dasenbrock 29 Dec. 1972 100 p refs
(AD-754738; NRL-7527) Avail: NTIS CSCL 22/3

A semianalytical method capable of analyzing both lunar and earth orbiters is presented. Primary attention is focused on predicting the evolution of the orbit as affected by third-body perturbations and those of the rotating primary. The singly averaged (literal) equations of motion are expanded by machine to a high order in the parallax factor and the mean motion ratio. These equations are numerically integrated to yield the orbital evolution and stability for a wide range of initial conditions. In addition, a purely analytical method is introduced to yield the orbital lifetimes for a special class of orbits. Author (GRA)

N73-20870# Wisconsin Univ., Madison. Dept. of Computer Sciences.
THE PERIHELION OF MERCURY
Ramon E. Moore and Donald Greenspan Oct. 1972 34 p
(PB-213059; WIS-CS-72-161) Avail: NTIS HC $3.00 CSCL 03C

Local finite Taylor series expansion is shown to be an efficient numerical method for the study of the n-body problem. Application is made to the accurate determination of the motion of the perihelion of Mercury according to Newtonian celestial mechanics. Author (GRA)

N73-20871# Owens Valley Radio Observatory, Pasadena, Calif.
A SEARCH FOR LAMBDA 21 cm ABSORPTION IN QSS AND OTHER SOURCES NEAR TO SPIRAL GALAXIES
M. C. Wright and S. T. Gottesman 1972 15 p refs Prepared in cooperation with Natl. Radio Astron. Obs., Charlottesville, Va. Sponsored in part by NSF
(Contract N00014-67-A-0094-0019)
(AD-754120; Rept-1972-14) Avail: NTIS CSCL 03/2

Observations are described which attempt to detect lambda 21 cm absorption in the spectra of 3C275.1, 3C232, 3C13 and 4C29.03 which are within 2 Holmberg radii of Sc and Sb type galaxies. None was found to a limiting rms absorption of 1, 2, 1.5 and 2.5% respectively in a 21 km/s bandwidth. The regions around these sources have also been observed for lambda 21 cm emission. No line emission has been detected in the regions around 3C232 and 3C13, but emission detected from the Sc galaxy NGC4651 gives an average HI surface density of 5.5 x 10 to the 20th power/sq cm for the region including 3C275.1. Adopting a model for the neutral HI distribution leads to a gas kinetic temperature that may be in excess of 18K. Author (GRA)

N73-20872# Owens Valley Radio Observatory, Pasadena, Calif.
A SURVEY OF ELLIPITICAL GALAXIES AT 6 cm
R. D. Ekers and J. A. Ekers 1972 27 p refs
(Contract N00014-67-A-0094-0019; Grant NSF GP-25225)

(AD-754121; Rept-1972-15) Avail: NTIS CSCL 03/2

The paper reports the results of a 6 cm radio continuum survey of 191 E and SO galaxies with known redshifts. Nineteen galaxies were detected. These were reobserved at higher resolution and could be divided into well separated classes of compact and extended sources. The extended emission was found only in giant E galaxies whereas the compact radio sources were also found in less luminous E galaxies. This may affect the use of radio galaxies as standard candles in cosmology. The presence of optical emission lines is well correlated with compact radio emission. The authors discuss the possibility that the SO galaxies detected are in fact misclassified E or D galaxies. Author (GRA)

N73-20873# Owens Valley Radio Observatory, Pasadena, Calif.
OBSERVATIONS, 327 MHz, OF THE GALACTIC CENTER: POSSIBLE DETECTION OF A DEUTERIUM ABSORPTION LINE
Alan T. Moffet, Jay M. Pasachoff (Williams Coll.), and Diego A. Cesarsky 1972 18 p refs
(Contract N00014-67-A-0094-0019)
(AD-754079; Rept-1972-16) Avail: NTIS CSCL 03/2

The authors observed the spectrum of radiation from the galactic center in the vicinity of the deuterium ground-state hyperfine transition. With about 100 hours of observing time the spectrum shows rms fluctuations about 7 x 10 to the minus 5th power of the on-source power level. An absorption feature at 327.38837 plus or minus .00001 MHz (corrected to the local standard of rest) has a depth of 2 x 10 to the minus 4th power of the continuum level. This feature is probably the deuterium line at v(LSR)+ or - 3.7 km/s. A discussion is included of the abundance of interstellar deuterium relative to hydrogen and of the difficulties in calculating it. Uncertainties include the optical depth of the corresponding hydrogen absorption line, which is saturated, and the distribution of absorbing clouds.
Author (GRA)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also; 28 Propulsion Systems; and 32 Structural Mechanics.

N73-20874*# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
COMBINED LOADING CRITERIAL INFLUENCE ON STRUCTURAL PERFORMANCE Final Report
B. J. Kuchta, D. M. Sealey, and L. J. Howell 30 Jun. 1972 187 p refs
(Contract NAS8-26916)
(NASA-CR-124113; GDCA-DDE72-004) Avail: NTIS HC $11.50 CSCL 22B

An investigation was conducted to determine the influence of combined loading criteria on the space shuttle structural performance. The study consisted of four primary phases: Phase (1) The determination of the sensitivity of structural weight to various loading parameters associated with the space shuttle. Phase (2) The determination of the sensitivity of structural weight to various levels of loading parameter variability and probability. Phase (3) The determination of shuttle mission loading parameters variability and probability as a function of design evolution and the identification of those loading parameters where inadequate data exists. Phase (4) The determination of rational methods of combining both deterministic time varying and probabilistic loading parameters to provide realistic design criteria. The study results are presented. Author

N73-20875*# Lockheed Missiles and Space Co., Huntsville, Ala.
MASS TRANSPORT CONTAMINATION STUDY Final Report
S. J. Robertson Jan. 1972 86 p refs
(Contract NAS8-26554)
(NASA-CR-124131; HREC-6554-4) Avail: NTIS HC $6.50 CSCL 22A

A theoretical analysis was performed to determine the effects of outgassing and waste dumping on the contamination field around an orbiting spacecraft. The spacecraft was assumed to be spherical in shape with the mass flow emitting uniformly from the spherical surface at a constant rate and in a D'Lambertian spatial distribution. The outflow of gases were assumed to be neutraliy charged and of a single species with a molecular weight characteristic of a composite of the actual species involved in the mass flow. The theoretical analysis showed that, for outgassing only, less than 1.5 percent of the outgas products will return to the Skylab spacecraft as a result of intermolecular collisions. When the total mass flow from the spacecraft, including waste dumps and reaction control motor firings, was considered, it was estimated that about 30 percent will return to the spacecraft. Author

N73-20876*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
MATHEMATICAL MODEL OF A FLEXIBLE SPACE SHUTTLE VEHICLE
C. A. Harvey Dec. 1972 84 p refs
(Contract NAS8-25708)
(NASA-CR-124159; HONEYWELL-12238-IR2) Avail: NTIS HC $6.25 CSCL 22B

The development of a mathematical model of the lateral motion of a flexible space shuttle vehicle during ascent is described. The model was developed to perform control system synthesis using stochastic constrained optimization techniques. The goals of the control system synthesis are to demonstrate the applicability of the techniques and to discover any problems peculiar to the flexible nature of a shuttle vehicle. The equations of motion are derived. A brief description of the generation of numerical data is given. Explicit definitions and numerical values of trajectory data and coefficients appearing in the equations of motion are included. Author

N73-20877*# TRW Systems, Redondo Beach, Calif.
STUDY OF THE DYNAMICS OF ORBITAL ASSEMBLIES INCLUDING INTERACTIONS WITH GEOMETRICAL APPENDAGES
D. J. Ness Dec. 1972 197 p refs
(Contracts NAS8-26131; NAS8-28169)
(NASA-CR-124170; TRW-14938-6010-R0-00) Avail: NTIS HC $12.00 CSCL 22B

The complete equations for the Unified Flexible Spacecraft Simulation (UFSS) program developed for the NASA/MSFC are presented. This general purpose simulation program is based on an algorithm which utilizes the digital computer to synthesize the dynamic and kinematic equations for a topological tree configuration of N interconnected bodies (the interconnected system of bodies forms no closed loops), the terminal members of which may be flexible. Necessary input quantities to the dynamic subroutine include the mass and inertia properties of each body and the flexible characteristics of each terminal member in addition to the specification, for each body, of those bodies to which it connects. This latter description involves the specification of the number of rotational degrees of freedom at each interconnection along with the associated position vectors defining these connections relative to the mass centers of the bodies involved. These position vectors can be input as time-varying functions if desired, thus affording the capability of studying the effects of time-varying hinge locations. Springs and dampers are assumed to act at each interconnection and structural damping in the flexible terminal members is included in the form of equivalent viscous damping. Author

N73-20878*# TRW Systems, Redondo Beach, Calif.
STUDY OF THE DYNAMICS OF ORBITAL ASSEMBLIES INCLUDING INTERACTIONS WITH GEOMETRICAL APPENDAGES. UNIFIED FLEXIBLE SPACECRAFT LOAD PROGRAM (LOAD): FINAL REPORT AND USER'S AND OPERATION MANUAL
D. J. Ness and G. Hull Dec. 1972 67 p refs
(Contract NAS8-26131)
(NASA-CR-124168; TRW-14938-6013-R0-00) Avail: NTIS HC $5.50 CSCL 22B

The addition of a dynamic loads computation capability to the Unified Flexible Spacecraft Simulation (UFSS) program is discussed. The added capability provides a means for determining

the internal member loads due to the time-varying external loading conditions experienced by an orbiting spacecraft/cluster. The flexible bodies are modeled as a system of joints or nodes which are interconnected by weightless finite element members. All masses are lumped at the joints. The orthogonal functions used to describe the spatial deformation of the bodies are normally taken to be the orthonormal cantilever modes produced by a standard structural dynamics program. Author

N73-20879*# Ball Bros. Research Corp., Boulder, Colo.
OSO-7 ORBITING SOLAR OBSERVATORY PROGRAM Final Report
31 Dec. 1972 280 p
(Contract NAS5-9300)
(NASA-CR-130157; F72-01) Avail: NTIS HC $16.00 CSCL 22B

The seventh Orbiting Solar Observatory (OSO-7) in the continuing series designed to gather solar and celestial data that cannot be obtained from the earth's surface is described. OSO-7 was launched September 29, 1971. It has been highly successful in returning scientific data giving new and important information about solar flare development, coronal temperature variations, streamer dynamics of plasma flow, and solar nuclear processes. OSO-7 is expected to have sufficient lifetime to permit data comparisons with the Skylab A mission during 1973. The OSO-7 is a second generation observatory. It is about twice as large and heavy as its predecessors, giving it considerably greater capability for scientific measurements. This report reviews mission objectives, flight history, and scientific experiments; describes the observatory; briefly compares OSO-7 with the first six OSO's; and summarizes the performance of OSO-7. Author

N73-20880*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANTI-METEOROID DEVICE Patent Application
John D. DiBattista, inventor (to NASA) Filed 13 Mar. 1973 14 p
(NASA-Case-LAR-10788-1; US-Patent-Appl-SN-340865) Avail: NTIS HC $3.00 CSCL 22B

Spacecraft structures to serve as anti-meteoroid devices are described. The structures consist of an outer wall constructed from a single laminate and an inner wall constructed of several laminates. The laminates are constructed of metals such as a aluminum and steel in one case. In the other case the laminates are constructed of low density materials such as rubber or polycarbonate. The combination, of an outer wall and a laminated inner wall is expected to dissipate the kinetic energy of a high velocity object striking the surface. NASA

N73-20881*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: FLIGHT INSTRUMENTATION CALIBRATION
J. F. DeMoss Washington Mar. 1973 13 p
(NASA-TN-D-7144; MSC-S-359) Avail: NTIS HC $3.00 CSCL 22B

Three types of instrumentation-calibration data were used in the Apollo Program to provide the correct engineering data for tests and mission support. The command and service module instrumentation-component procurement specifications required individual-component calibration, and calibration data for these individual components (conventional-calibration data) were always used for mission data support. A mean standard type of calibration data derived from a statistical sampling of conventional-calibration data was used for test and checkout during the latter part of the Apollo Program. The lunar module instrumentation procurement specification permitted the use of standard-calibration data. These data were applicable to similarly instrumented measurements. The definition, merit, and application of each type of data are discussed. Author

N73-20882*# National Aeronautics and Space Administration, Washington, D.C.
THE INTERPLANETARY PIONEERS. VOLUME 3: OPERATIONS
William R. Corliss 1972 157 p refs
(NASA-SP-280; LC-74-176234) Avail: NTIS MF $0.95; SOD $1.75 domestic postpaid or $1.50 GPO Bookstore CSCL 22B

The operational aspects of the Pioneer program are described. The phases of the program discussed include: prelaunch operations, launch to DSS acquisition, near-earth operations, nominal and extended cruise, and scientific results. F.O.S.

N73-20883*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GRAVITATIONAL FIELD MODES GEM 3 AND 4
Francis J. Lerch, Carl A. Wagner, Barbara H. Putney, Mark L. Sandson (Computer Sci. Corp.), Joseph E. Brownd (Computer Sci. Corp.), James A. Richardson (Computer Sci. Corp.), and Wayne A. Taylor (Computer Sci. Corp.) Nov. 1972 42 p refs Presented at Intern. Symp. on Earth Gravity Models and Related Problems, St. Louis, Mo., 16-18 Aug. 1972
(NASA-TM-X-66207; X-592-72-476) Avail: NTIS HC $4.25 CSCL 22B

A refinement in the satellite geopotential solution for a Goddard Earth Model (GEM 3) was obtained. The solution includes the addition of two low inclination satellites, SAS at 3 deg and PEOLE at 15 deg, and is based upon 27 close earth satellites containing some 400,000 observations of electronic, laser, and optical data. In addition, a new combination satellite/gravimetry solution (GEM 4) was derived. The new model includes 61 center of mass tracking station locations with data from GRARR, Laser, MOTS, Baker-Nunn, and NWL Tranet Doppler tracking sites. Improvement was obtained for the zonal coefficients of the new models and is shown by tests on the long period perturbations of the orbits. Individual zonal coefficients agree very closely among different models that contain low inclination satellites. Tests of models with surface gravity data show that the GEM 3 satellite model has significantly better agreement with the gravimetry data than the GEM 1 satellite model, and that it also has better agreement with the gravimetry data than the 1969 SAO Standard Earth 2 model. Author

N73-20884*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATMOSPHERE EXPLORER CONTROL SYSTEM SOFTWARE (VERSION 2.0)
William Mocarsky and Anthony Villasenor Mar. 1973 93 p refs
(NASA-TM-X-66209; X-324-73-80) Avail: NTIS HC $6.75 CSCL 22B

The Atmosphere Explorer Control System (AECS) was developed to provide automatic computer control of the Atmosphere Explorer spacecraft and experiments. The software performs several vital functions, such as issuing commands to the spacecraft and experiments, receiving and processing telemetry data, and allowing for extensive data processing by experiment analysis programs. The AECS was written for a 48K XEROX Data System Sigma 5 computer, and coexists in core with the XDS Real-time Batch Monitor (RBM) executive system. RBM is a flexible operating system designed for a real-time foreground/background environment, and hence is ideally suited for this application. Existing capabilities of RBM have been used as much as possible by AECS to minimize programming redundancy. The most important functions of the AECS are to send commands to the spacecraft and experiments, and to receive, process, and display telemetry data. Author

N73-20885*# Aerospace Corp., El Segundo, Calif.
POGO SUPPRESSION ON SPACE SHUTTLE - EARLY STUDIES
S. Rubin, R. G. Wagner, and J. G. Payne Washington NASA Mar. 1973 131 p refs
(Contract NAS1-10631)
(NASA-CR-2210) Avail: NTIS HC $3.00 CSCL 22B

Preliminary studies for pogo prevention on the shuttle vehicle are reported. The importance of the effect of oscillatory outflow from a hydroelastic tank is displayed in terms of excitation of normal modes for a structure containing that tank assuming its outlet is closed. Evaluation of an approximate propulsion frequency response at undamped feedline resonance reveals the conditions for which the contribution of tank outflow is destabilizing and also provides a criterion for identifying those structural modes which are of potential significance for system stability. Various finite-element and normal-mode models for hydraulic feedlines are evaluated relative to accuracy of admittances of a long line.

A procedure is recommended for modeling a feed system to minimize the required number of second-order equations. Specific recommendations are made for the analytical estimation of pump cavitation compliance and a first estimate for the shuttle pumps is given. Weakness in past practices of pump testing are identified and a new three-phase program is proposed. Finally results of numerical studies on the early vehicle configuration are presented. It is concluded that an accumulator between the boost and main pump offers promise of higher effectiveness than one at the engine inlet. Author

N73-20886*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SCIENTIFIC INVOLVEMENT IN SKYLAB BY THE SPACE SCIENCES LABORATORY OF THE MARSHALL SPACE FLIGHT CENTER
Carl E. Winkler, ed. 28 Feb. 1973 124 p refs
(NASA-TM-X-64725) Avail: NTIS HC $8.25 CSCL 22B

The involvement of the Marshall Space Flight Center's Space Sciences Laboratory in the Skylab program from the early feasibility studies through the analysis and publication of flight scientific and technical results is described. This includes mission operations support, the Apollo telescope mount, materials science/manufacturing in space, optical contamination, environmental and thermal criteria, and several corollary measurements and experiments. Author

N73-20887*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 17 30-DAY FAILURE AND ANOMALY LISTING REPORT
Feb. 1973 41 p
(NASA-TM-X-69126; MSC-07762) Avail: NTIS HC $4.25 CSCL 14D

The significant anomalies that occurred during the Apollo 17 mission are discussed. The discussion is divided into five major sections: (1) command and service modules, (2) lunar module, (3) government-furnished equipment, (4) lunar surface experiments, and (5) orbital experiments. All times are elapsed time from range zero, established as the integral second before lift-off. Author

N73-20888*# Chrysler Corp., New Orleans, La. Data Management Services.
SPACE SHUTTLE: AERODYNAMIC CHARACTERISTICS OF A 162-INCH DIAMETER SOLID ROCKET BOOSTER WITH AND WITHOUT STRAKES
Josh D. Johnson (NASA. Johnson Space Center), Walter D. Radford (Northrop Serv., Inc.), and John M. Rampy (Northrop Serv., Inc.) Mar. 1973 313 p
(Contract NAS9-13247)
(NASA-CR-120090; DMS-DR-2012) Avail: NTIS HC $17.75 CSCL 22B

Tests conducted at NASA-Langley have shown that a small flap or strake can generate a significant amount of lift on a circular cylinder with large cross flow. If strakes are placed on the opposite sides and ends on a circular body, a moment will be produced about the center of mass of the body. The purpose of this test was to determine the static-aerodynamic forces and moments of a 162-inch diameter SRB (PRR) with and without strakes. The total angle-of-attack range of the SRB test was from -10 to 190 degrees. Model roll angles were 0, 45, 90, and 135 degrees with some intermediate angles. The Mach range was from 0.6 to 3.48. The 0.00494 scale model was designated as MSFC No. 449. Author

N73-20889*# Linkabit Corp., San Diego, Calif.
STUDY OF INFORMATION TRANSFER OPTIMIZATION FOR COMMUNICATION SATELLITES Final Report
Joseph P. Odenwalder, Andrew J. Viterbi, Irwin Mark Jacobs, and Jerrold A. Heller 3 Jan. 1973 112 p refs
(Contract NAS2-6810)
(NASA-CR-114561) Avail: NTIS HC $7.75 CSCL 22B

The results are presented of a study of source coding, modulation/channel coding, and systems techniques for application to teleconferencing over high data rate digital communication satellite links. Simultaneous transmission of video, voice, data, and/or graphics is possible in various teleconferencing modes and one-way, two-way, and broadcast modes are considered. A satellite channel model including filters, limiter, a TWT, detectors, and an optimized equalizer is treated in detail. A complete analysis is presented for one set of system assumptions which exclude nonlinear gain and phase distortion in the TWT. Modulation, demodulation, and channel coding are considered, based on an additive white Gaussian noise channel model which is an idealization of an equalized channel. Source coding with emphasis on video data compression is reviewed, and the experimental facility utilized to test promising techniques is fully described. Author

N73-20890*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: PRELIMINARY PRESSURE DISTRIBUTIONS ON THE 049 ORBITER, ORBITER IN PRESENCE OF H/O TANK AND ORBITER IN LAUNCH CONFIGURATION
J. T. Hamilton (Northrop Services, Inc.), J. M. Rampy (Northrop Services, Inc.), and J. F. Sims (NASA. MSFC) Jan. 1973 208 p
(Contract NAS8-4016)
(NASA-CR-120066; DMS-DR-1259) Avail: NTIS HC $12.50 CSCL 22B

The 049 orbiter and launch configurations were tested in a trisonic wind tunnel to obtain preliminary loads information on the orbiter alone, orbiter in presence of the H/O tank and orbiter in the full launch configuration. The orbiter consisted of the baseline 049 double-delta wing, twin vertical stabilizers, seven degrees of dihedral and included abort rockets. The orbiter was mounted at minus 1.50 degree of incidence (fuselage centerline relative to H/O tank centerline) in the launch configuration. The solid rocket motors were mounted at a radial location of 21 degrees from the horizontal centerline of the H/O tank. The test was conducted over a Mach number range of 0.6 to 4.96. Nominal angle of attack and angle of sideslip ranges of minus 6 to plus 6 degrees were tested. In addition, the orbiter alone was tested over an angle of attack range of minus 6 to plus 26 degrees. Author

N73-20891*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: PRESSURE INVESTIGATION OF A SPACE SHUTTLE LAUNCH CONFIGURATION CONSISTING OF A DELTA-WING ORBITER AND A SWEPT-WING BOOSTER WITH CANARD AND TIP FANS (M EQUALS 0.6 TO 1.3). VOLUME 1, PART A: BOOSTER DATA
J. M. Rampy (Northrop Services, Inc.), K. L. Blackwell (NASA. MSFC), and G. R. Gomillion (ARO, Inc.) Jan. 1973 560 p refs
(Contract NAS8-4016)
(NASA-CR-120034-Vol-1-Pt-A; DMS-DR-1222-Vol-1-Pt-A) Avail: NTIS HC $30.00 CSCL 22B

Wind tunnel tests to determine the pressure distribution on a space shuttle launch configuration consisting of a delta wing orbiter and a swept wing booster with canard and tip fins were conducted. Pressure data were obtained for the combined orbiter and booster and for the booster alone at Mach numbers from 0.6 to 1.3, angles of attack from minus 8 degrees to plus 10 degrees, and sideslip angles from minus 6 degrees to plus 6 degrees. Pressure data were also obtained for the booster alone without canard at Mach numbers of 0.9 and 1.1. The pressure taps were distributed primarily over the booster upper surface and the orbiter lower surface. Author

N73-20892*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: PRESSURE INVESTIGATION OF A SPACE SHUTTLE LAUNCH CONFIGURATION CONSISTING OF A DELTA-WING ORBITER AND A SWEPT-WING BOOSTER WITH CANARD AND TIP FINS (M EQUALS 0.6 TO 1.3). VOLUME 1, PART B: BOOSTER DATA
J. M. Rampy (Northrop Services, Inc.), K. L. Blackwell (NASA. MSFC), and G. R. Gomillion (ARO, Inc.) Jan. 1973 586 p refs
(Contract NAS8-4016)
(NASA-CR-120034-Vol-1-Pt-B; DMS-DR-1222-Vol-1-Pt-B) Avail: NTIS HC $31.50 CSCL 22B

For abstract, see N73-20891.

N73-20893*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: PRESSURE INVESTIGATION OF A SPACE SHUTTLE LAUNCH CONFIGURATION CONSISTING OF A DELTA-WING ORBITER AND A SWEPT-WING BOOSTER WITH CANARD AND TIP FINS (M EQUALS 0.6 TO 1.3). VOLUME 2: ORBITER DATA
J. M. Rampy (Northrop Services, Inc.), K. L. Blackwell (NASA. MSFC), and G. R. Gomillion (ARO, Inc.) Jan. 1973 514 p refs
(Contract NAS8-4016)
(NASA-CR-120034-Vol-2; DMS-DR-1222-Vol-2) Avail: NTIS HC $27.75 CSCL 22B
For abstract, see N73-20891

N73-20894*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
DEVELOPMENT OF A WEIGHT/SIZING DESIGN SYNTHESIS COMPUTER PROGRAM. VOLUME 1: PROGRAM FORMULATION Final Report
J. M. Garrison 28 Feb. 1973 292 p refs 3 Vol.
(Contract NAS9-12989)
(NASA-CR-128867; MDC-E0746-Vol-1) Avail: NTIS HC $16.75 CSCL 22B

The development of a weight/sizing design synthesis methodology for use in support of the main line space shuttle program is discussed. The methodology has a minimum number of data inputs and quick turn around capabilities. The methodology makes it possible to: (1) make weight comparisons between current shuttle configurations and proposed changes, (2) determine the effects of various subsystems trades on total systems weight, and (3) determine the effects of weight on performance and performance on weight. Author

N73-20895*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
DEVELOPMENT OF A WEIGHT/SIZING DESIGN SYNTHESIS COMPUTER PROGRAM. VOLUME 2: PROGRAM DESCRIPTION Final Report
J. M. Garrison 28 Feb. 1973 95 p refs 3 Vol.
(Contract NAS9-12989)
(NASA-CR-128868; MDC-E0746-Vol-2) Avail: NTIS HC $6.75 CSCL 22B

The program for the computerized analysis of weight estimation relationships for those elements of the space shuttle vehicle which contribute a significant portion of the inert weight is discussed. A listing of each module and subroutine of the program is presented. Included are a generalized flow chart describing the subroutine linkage of the complete program and detailed flow charts for each subprogram. Author

N73-20896*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
DEVELOPMENT OF WEIGHT/SIZING DESIGN SYNTHESIS COMPUTER PROGRAM. VOLUME 3: USER MANUAL Final Report
J. M. Garrison 28 Feb. 1973 95 p 3 Vol.
(Contract NAS9-12989)
(NASA-CR-128869; MDC-E0746-Vol-3) Avail: NTIS HC $6.75 CSCL 22B

The user manual for the weight/sizing design synthesis program is presented. The program is applied to an analysis of the basic weight relationships for the space shuttle which contribute significant portions of the inert weight. The relationships measure the parameters of load, geometry, material, and environment. A verbal description of the processes simulated, data input procedures, output data, and values present in the program is included. Author

N73-20897*# General Dynamics/Convair, San Diego, Calif.
MODIFICATION AND UPDATING OF THE MANNED ACTIVITY SCHEDULING SYSTEM (MASS) FOR SHUTTLE AND SHUTTLE PAYLOADS ANALYSIS. VOLUME 1: MODEL SPECIFICATIONS Final Report, Jun. 1972 - Mar. 1973
R. C. Ring Apr. 1973 44 p refs
(Contract NAS1-11674)
(NASA-CR-112286) Avail: NTIS HC $4.25 CSCL 22B

The LRC MASS was modified and updated to include logic for efficient analysis of space shuttle payload operations. All MASS computer models were reviewed for compatibility with, and applicability to, the shuttle sortie mission. The MASS modification efforts were concentrated on two computer programs, the general scheduling model (GSM) and one day model (ODM). A new computer program, the DAYLIB Tape Processor, was developed to update the link between the GSM and ODM. The resulting MASS is an operationally efficient analytical tool that will allow a rapid assessment of shuttle and shuttle payload operations. Author

N73-20898*# General Dynamics/Convair, San Diego, Calif.
MODIFICATION AND UPDATING OF THE MANNED ACTIVITY SCHEDULING SYSTEM (MASS) FOR SHUTTLE AND SHUTTLE PAYLOADS ANALYSIS. VOLUME 2: SPACE SHUTTLE SORTIE PAYLOAD ANALYSIS Final Report, Jun. 1972 - Mar. 1973
R. C. Huyett and R. C. Ring Apr. 1973 80 p refs
(Contract NAS1-11674)
(NASA-CR-112287) Avail: NTIS HC $6.00 CSCL 22B

Space shuttle operations include a significant number of launches with a sortie laboratory serving as a facility for manned experimentation in space. Planning a program of space experiments for a facility of this type requires that both the composition of the laboratory payload and the schedule of experiment operations for each payload be carefully selected. Experiment operations are investigated using the manned activity scheduling system (MASS). Schedules provided by these models assist in selecting experiment groups that efficiently use the laboratory resources and yield the desired experiment accomplishment at the program level. An alternate use of the MASS models provides for establishing the time-dependent supporting resources required for a specified candidate payload. A procedure for defining and analyzing shuttle sortie payloads was developed. This procedure was then applied to the definition of mixed-discipline experiment payloads for an advanced technology laboratory (ATL) supported by two-and three-man crews. The ATL payloads, including schedules of experiment operations, were defined to realize a high percentage of experiment accomplishment. The study considers the sensitivity of experiment accomplishment rate to variations of system parameters such as crew cross training, crew operations, shuttle and laboratory resources, ground target systems, and operational orbits. Author

N73-20899*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SPACE TUG ECONOMIC ANALYSIS STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
Jun. 1972 69 p Prepared jointly with Mathematica, Inc.
(Contract NAS8-27709)
(NASA-CR-124142; LMSC-D153408-Vol-1; DR-MA-04-Vol-1)
Avail: NTIS HC $5.50 CSCL 22B

An economic analysis of space tug operations is presented. The space tug is defined as any liquid propulsion stage under 100,000 pounds propellant loading that is flown from the space shuttle cargo bay. Two classes of vehicles are the orbit injection stages and reusable space tugs. The vehicle configurations, propellant combinations, and operating modes used for the study are reported. The summary contains data on the study approach, results, conclusions, and recommendations. Author

N73-20900*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SPACE TUG ECONOMIC ANALYSIS STUDY. VOLUME 2: TUG CONCEPTS ANALYSIS. PART 1: OVERALL APPROACH AND DATA GENERATION Final Report
May 1972 158 p Prepared jointly with Mathematica, Inc.
(Contract NAS8-27709)
(NASA-CR-124143; LMSC-D153408-Vol-2-pt-1;
DR-MA-04-Vol-2-Pt-1) Avail: NTIS HC $10.00 CSCL 22B

An economic analysis of space tug operations is presented. The subjects discussed are: (1) data base for orbit injection stages, (2) data base for reusable space tug, (3) performance equations, (4) data integration and interpretation, (5) tug performance and mission model accomodation, (6) total program cost, (7) payload analysis, (8) computer software, and (9) comparison of tug concepts. Author

N73-20901*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SPACE TUG ECONOMIC ANALYSIS STUDY. VOLUME 2: TUG CONCEPTS ANALYSIS. PART 2: ECONOMIC ANALYSIS Final Report
May 1972 87 p Prepared jointly with Mathematica, Inc.
(Contract NAS8-27709)
(NASA-CR-124144; LMSC-D153408-Vol-2-Pt-2; DR-MA-04-Vol-2-Pt-2) Avail: NTIS HC $6.50 CSCL 22B

An economic analysis of space tug operations is presented. The subjects discussed are: (1) cost uncertainties, (2) scenario analysis, (3) economic sensitivities, (4) mixed integer programming formulation of the space tug problem, and (5) critical parameters in the evaluation of a public expenditure. Author

N73-20902*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SPACE TUG ECONOMIC ANALYSIS STUDY. VOLUME 2: TUG CONCEPTS ANALYSIS. APPENDIX: TUG DESIGN AND PERFORMANCE DATA BASE Final Report
May 1972 213 p Prepared jointly with Mathematica, Inc.
(Contract NAS8-27709)
(NASA-CR-124146; LMSC-D153408-Vol-2-App; DR-MA-04-Vol-2-App) Avail: NTIS HC $13.00 CSCL 22B

The tug design and performance data base for the economic analysis of space tug operation are presented. A compendium of the detailed design and performance information from the data base is developed. The design data are parametric across a range of reusable space tug sizes. The performance curves are generated for selected point designs of expendable orbit injection stages and reusable tugs. Data are presented in the form of graphs for various modes of operation. Author

N73-20903*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SPACE TUG ECONOMIC ANALYSIS STUDY. VOLUME 3: COST ESTIMATES Final Report
May 1972 156 p Prepared jointly with Mathematica, Inc.
(Contract NAS8-27709)
(NASA-CR-124147; LMSC-D153408-Vol-3; DR-MA-04-Vol-3) Avail: NTIS HC $10.00 CSCL 22B

Cost estimates for the space tug operation are presented. The subjects discussed are: (1) research and development costs, (2) investment costs, (3) operations costs, and (4) funding requirements. The emphasis is placed on the single stage tug configuration using various types of liquid propellants. Author

N73-20904# Army Missile Command, Redstone Arsenal, Ala. Advanced Sensors Directorate.
GENERAL PURPOSE SIX DEGREE OF FREEDOM TERMINAL HOMING MISSILE SIMULATION PROGRAM
Lewis G. Minor 31 Aug. 1972 92 p
(DA Proj. 1M2-62303-A-214)
(AD-754543; RE-TR-72-16) Avail: NTIS CSCL 16/2

The report contains a description of a general purpose, 6-degree of freedom terminal homing missile simulation. The program uses quaternions for the coordinate transformations and features the use of subroutines to enter seeker, autopilot, aerodynamic, and wind models. Author (GRA)

N73-20905# Grumman Aerospace Corp., Bethpage, N.Y.
FINITE ELEMENT MODELING AND OPTIMIZATION OF AEROSPACE STRUCTURES Final Report, 15 Apr. 1971 - 15 Apr. 1972
Walter J. Dwyer Aug. 1972 59 p refs
(Contract F33615-72-C-1466; AF Proj. 1467)
(AD-754915; AFFDL-TR-72-59) Avail: NTIS CSCL 22/2

The report documents a study made of the optimization of typical aircraft structural components using the Automated Structural Optimization Program (ASOP) described in AFFDL-TR-70-118. The structures examined were a fuselage structure for a proposed space shuttle orbiter and a wing structure for the same vehicle. Examples are given of practical finite element modeling of these structures. Author (GRA)

N73-20906# Naval Postgraduate School, Monterey, Calif.
SURVIABILITY OF THE FIVE INCH GUN LAUNCHED FINNED MOTOR CASE
Robert E. Ball 10 Aug. 1972 18 p refs
(AD-754378; NPS-57BP72081A) Avail: NTIS CSCL 19/7

The structural integrity of the motor case of a five-inch gun launched projectile is examined as a function of case thickness and maximum launch acceleration. The analysis techniques developed in a previous study of the buckling failure of a three-inch projectile motor case are applied to the five-inch case. Survivability curves are presented for case thicknesses of 0.09 in., 0.10 in., 0.12 in., 0.15 in., and 0.19 in. and a maximum launch acceleration of 7,000 g's. The 0.19 in. case under 6,000 g's is also examined. Both bonded and unbonded propellants are considered. Author (GRA)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N73-20907 National Lending Library for Science and Technology, Boston Spa (England).
AXIAL-SYMMETRICAL DEFORMATION OF ROTATORY BODIES
A. Timpe [1972] 28 p refs Transl. into ENGLISH from Z. Angew. Math. Mech. (Berlin), v. 4, no. 5, 1924 p 361-376 In ENGLISH and GERMAN
(NLL-M-22827-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The arrangement of basic formulas into Cartesian and curvilinear coordinates to study axial symmetrical distortions of rotary bodies is reported. Applications to circular - and circular ring-plates, cylinders, and spheroids are discussed. In the case of circular plates and circular ring plates, a critical observation of the fundamentals consequences of the usual approximation theory was made. E.H.W.

N73-20908 National Lending Library for Science and Technology, Boston Spa (England).
BRITTLE FRACTURE AND FATIGUE INVESTIGATIONS ON CYLINDRICAL HOLLOW BODIES WITH OFFSET CIRCUMFERENTIAL SEAMS AND DIFFERENT STIFFENERS
O. Steinhardt and F. Mang 4 Dec. 1972 13 p Transl. into ENGLISH from VDI (Ver. Deut. Ingr.) Z. (Dusseldorf), v. 114, no. 13, Sep. 1972 p 985-991
(NLL-Risley-TR-2527-(9001.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

As a result of inaccuracies during manufacture and assembly, when pipes and vessels are welded, circumferential-seam offsets can be produced, the seam being otherwise perfect. The question that must then be decided is whether such a manufacturing defect can be allowed to remain without being corrected. The investigations showed that there were no important differences between stiffened hollow bodies and hollow bodies with a circumferential-seam offset. An offset circumferential seam was also found not to be a pronounced weak point in the case of a sudden internal pressure load and in the case of a pulsating internal pressure. Author

N73-20909 National Physical Lab., Teddington (England). Div. of Maritime Science.
A WIND TUNNEL INVESTIGATION FOR THE PROPOSED QANTAS CENTRE, SYDNEY, AUSTRALIA
R. E. Whitbread, C. F. Cowdrey, P. G. G. ONeill, and D. J. Young Oct. 1972 172 p refs
(NPL-Tech-Memo-Mar-Sci-TM-100) Copyright. Avail: Issuing Activity

The major effects of wind on the design of a tall building are examined. Particular emphasis was placed on obtaining the closest possible representation of the relevant properties of the natural wind, within the limitations imposed by the available wind tunnels. Pressure, force, and moment coefficients are presented for design purposes and methods for reducing wind speeds in the podium area. Measurements of the wind-induced amplitudes of oscillation have indicated that turbulence-induced

motion may be perceptible to the occupants at high wind speeds, but that instabilities due to narrow band vortex shedding and galloping are unlikely to occur. Author

N73-20911*# University of South Florida, Tampa. Coll. of Engineering.
ELASTIC PLATE SPALLATION Final Report
Larry Oline and John Medaglia 31 May 1972 115 p refs
(Grant NGR-10-008-028)
(NASA-CR-112294) Avail: NTIS HC $7.75 CSCL 20K

The dynamic finite element method was used to investigate elastic stress waves in a plate. Strain displacement and stress strain relations are discussed along with the stiffness and mass matrix. The results of studying point load, and distributed load over small, intermediate, and large radii are reported. The derivation of finite element matrices, and the derivation of lumped and consistent matrices for one dimensional problems with Laplace transfer solutions are included. The computer program JMMS-PALL is also included. F.O.S.

N73-20912*# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
ALTERNATING METHOD APPLIED TO EDGE AND SURFACE CRACK PROBLEMS
R. J. Hartranft and G. C. Sih Apr. 1972 111 p refs
(Grant NGR-39-007-066)
(NASA-CR-112299; TR-1; IFSM-72-13) Avail: NTIS HC $7.75 CSCL 20K

The Schwarz-Neumann alternating method is employed to obtain stress intensity solutions to two crack problems of practical importance: a semi-infinite elastic plate containing an edge crack which is subjected to concentrated normal and tangential forces, and an elastic half space containing a semicircular surface crack which is subjected to uniform opening pressure. The solution to the semicircular surface crack is seen to be a significant improvement over existing approximate solutions. Application of the alternating method to other crack problems of current interest is briefly discussed. Author

N73-20913*# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
LOAD INTERACTION EFFECTS ON FATIGUE CRACK GROWTH IN Ti-6Al-4V ALLOY
R. P. Wei, T. T. Shih, and J. H. FitzGerald Washington NASA Apr. 1973 28 p refs
(Grant NGL-39-007-040)
(NASA-CR-2239; IFSM-72-15) Avail: NTIS HC $3.00 CSCL 20K

The importance of delay, retardation in the rate of fatigue crack growth, produced by load interactions in variable amplitude loading, on the accurate prediction of fatigue lives of engineering structures is discussed. The effects of a broad range of loading variables on delay in fatigue crack growth at room temperature are examined for a mill annealed Ti-6Al-4V alloy. The results are used to estimate crack growth behavior under programmed loads. Author

N73-20914*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT AND APPLICATION OF VIBROACOUSTIC STRUCTURAL DATA BANKS IN PREDICTING VIBRATION DESIGN AND TEST CRITERIA FOR ROCKET VEHICLE STRUCTURES
H. J. Bandgren and W. C. Smith Washington Feb. 1973 148 p refs
(NASA-TN-D-7159) Avail: NTIS HC $3.00 CSCL 20K

A method of predicting broadband random vibration criteria for components on space vehicles is presented. Large amounts of vibration and acoustic data obtained from flights and static firing tests of space vehicle were formulated into vibroacoustic data banks for structural categories of ring frame, skin stringer, and honeycomb. The vibration spectra with their associated acoustic spectra are normalized to a reference acoustic spectrum. The individual normalized spectra are grouped according to definite structural characteristics and statistically analyzed to form the vibroacoustic data banks described in this report. These data banks represent the reference vibration criteria available for determining the new vehicle vibration criteria. Author

N73-20915*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL STATIC BENDING OF DEPLOYABLE INTERLOCKED BOOMS
Charles L. Staugaitis and Roamer E. Predmore Washington Mar. 1973 51 p refs
(NASA-TN-D-7243; G-1076) Avail: NTIS HC $3.00 CSCL 20K

Metal ribbons processed with a heat-forming treatment are enabled to form tubelike structures when deployed from a roll. Deployable booms of this have been utilized for gravity-gradient stabilization on the RAE, ATS, and Nimbus D satellites. An experimental thermal-mechanics test apparatus was developed to measure the thermal static bending and twist of booms up to 3 meters long. The apparatus was calibrated by using the correlation between calculated and observed thermal bending of a seamless tube. Thermal static bending values of 16 interlocked deployable booms were observed to be within a factor of 2.5 of the values calculated from seamless-tube theory. Out-of-Sun-plane thermal bending was caused by complex heat transfer across the interlocked seam. Significant thermal static twisting was not observed. Author

N73-20916*# Universal Analytics, Inc., Los Angeles, Calif.
ADDITION OF THREE-DIMENSIONAL ISOPARAMETRIC ELEMENTS TO NASA STRUCTURAL ANALYSIS PROGRAM (NASTRAN) Final Report
E. I. Field and S. E. Johnson 24 Jan. 1973 134 p refs
(Contract NAS1-11677)
(NASA-CR-112269) Avail: NTIS HC $8.75 CSCL 20K

Implementation is made of the three-dimensional family of linear, quadratic and cubic isoparametric solid elements into the NASA Structural Analysis program, NASTRAN. This work included program development, installation, testing, and documentation. The addition of these elements to NASTRAN provides a significant increase in modeling capability particularly for structures requiring specification of temperatures, material properties, displacements, and stresses which vary throughout each individual element. Complete program documentation is presented in the form of new sections and updates for direct insertion to the three NASTRAN manuals. The results of demonstration test problems are summarized. Excellent results are obtained with the isoparametric elements for static, normal mode, and buckling analyses. Author

N73-20917*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THREE-DIMENSIONAL ELASTIC STRESS AND DISPLACEMENT ANALYSIS OF TENSILE FRACTURE SPECIMENS CONTAINING CRACKS
John P. Gyekenyesi, Alexander Mendelson, and Jon Kring Washington Apr. 1973 42 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland
(NASA-TN-D-7313; E-7170) Avail: NTIS HC $3.00 CSCL 20K

A seminumerical method is presented for three-dimensional elastic analysis of finite geometry solids with traction-free cracks. Stress and displacement distributions are calculated for two rectangular bars which are loaded by a uniform surface stress distribution. The first bar contains a through-thickness central

crack while the second bar has double-edge cracks. Stress intensity factors K sub I for both configurations are presented. Author

N73-20918# Watervliet Arsenal, N.Y.
APPLICATION OF A VARIATIONAL METHOD TO SOME DISSIPATIVE, NONCONSERVATIVE PROBLEMS OF ELASTIC STABILITY
Gary L. Anderson Sep. 1972 46 p refs
(AD-754532; WVT-7246; AROD-72-24) Avail: NTIS CSCL 20/11

The report deals with the development of an adjoint variational principle that forms the basis of a method that is used to obtain approximate solutions for nonconservative problems of elastic stability in which dissipative forces are present. For a general fifth order partial differential equation in time and one space variable, the associated adjoint boundary value problem is derived. A variational principle embodying both the original and the adjoint problems is developed. Three specific nonconservative stability problems are studied by this method and the numerical convergence of the approximate solutions is studied by enlarging suitably the number of modes retained in the assumed expansions of the deflection functions. It is found that internal damping may be either of a stabilizing or destabilizing nature, depending upon its magnitude as well as the magnitude of the external damping parameter. Author (GRA)

N73-20919# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Materials Directorate.
A DERIVATION OF PERTURBED EQUATIONS OF MOTION AND HEAT CONDUCTION OF A THERMOELASTIC SOLID
James J. Richardson 1 Nov. 1972 35 p refs
(DA Proj. 1T0-61101-A-91A)
(AD-754542; RL-TR-72-13) Avail: NTIS CSCL 20/11

The report presents a brief discussion of the finite element method and the derivation of the perturbed equations of motion and heat conduction for an element. The general equations are first derived; then nodal values of displacement, force, stress, entropy, temperature, heat flux, and heat flow are perturbed. Next, the material is assumed to follow anisotropic linear thermoelastic theory throughout its behavioral history. Alternatively, it is allowed to follow an unspecified theory in the gross behavior and anisotropic thermoelasticity only during the perturbations. No geometrical assumptions are made at this point concerning the finite element; therefore, the equations derived in Section II can be adapted to a wide class of finite element approximations. In Section III various aspects of structural stability are considered. First, a number of fundamental definitions and theorems are presented. This is followed by a discussion of the stability of the behavioral expressions formulated in Section II for specific types of systems. Author (GRA)

N73-20920# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELASTOPLASTIC STATE OF A ROUND PLATE WITH FINITE DEFLECTIONS
B. A. Gorlach 24 Nov. 1972 15 p Transl. into ENGLISH from Issled po Teorii Plastin i Obolochek (Kazan), no. 7, 1970 p 793-800
(AD-753983; FTD-HT-23-1517-72) Avail: NTIS CSCL 20/11

A study is made of the stressed state of a thin circular plate under the effect of axisymmetric loading. Equations in the displacements are obtained in accordance with a theory of small elastoplastic deformations with the consideration of geometrical nonlinearity. The solution was carried out using a digital computer. Author (GRA)

N73-20921# Alabama Univ., Huntsville. School of Graduate Studies and Research.
A FINITE ELEMENT ANALYSIS OF SHOCK AND FINITE-AMPLITUDE WAVES IN ONE-DIMENSIONAL HYPERELASTIC BODIES AT FINITE STRAIN
R. B. Fost and J. T. Oden Oct. 1972 45 p refs
(Contract F44620-69-C-0124; AF Proj. 9560; Proj. Themis)
(AD-754953; UAH-RR-135; AFOSR-73-0114TR) Avail: NTIS CSCL 20/11

The general theory of shock and acceleration waves in isotropic, incompressible, hyperelastic solids is used in conjunction with the concept of finite elements to construct discrete models of highly nonlinear wave phenomena in elastic rods. A numerical integration scheme which combines features of finite elements and the Lax-Wendroff method is introduced. Numerical calculations of the critical time for shock formulation are given. Numerical results obtained from representative cases are discussed. Author (GRA)

N73-20922# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USING GENERALIZED VIBRATIONAL METHODS IN THE CALCULATION OF PLATES
Yu. I. Butenko, A. I. Kutikov, and I. G. Teregulov 18 Jan. 1973 24 p refs Transl. into ENGLISH from Issled, Teor. Plastin Obolochek (Kazan), no. 7, 1970 p 186-200
(AD-754668; FTD-HT-23-1512-72) Avail: NTIS CSCL 20/11

Vibrational methods are used in place of the differential equations to solve problems dealing with the theory of elasticity. Some works connected with this problem are discussed and the variation of a functional developed by I. G. Teregulov is used in this work. Author (GRA)

N73-20923# North Carolina State Univ., Raleigh.
TWO-DIMENSIONAL STRESS WAVES RESULTING FROM AXISYMMETRIC IMPACT OF FINITE-LENGTH RODS
H. L. Chang and Y. Horie Jan. 1973 102 p refs
(Contract N00014-68-A-0187; NR Proj. 064-504)
(AD-754119; TR-73-1) Avail: NTIS CSCL 20/11

A numerical analysis has been developed to study the dynamic problem of axisymmetrically impacting, finite-length rods. The analysis is based upon the method of characteristics and the medium is assumed elastic/viscoplastic, satisfying von Mises yielding criterion, isotropic hardening, and viscoplastic incompressibility. The numerical results are in general comparable to those of elastic-plastic solids by the numerical finite-difference method. The paper examines the influence of viscoplasticity on two-dimensional stress wave propagation, dynamic Saint Venant's principle, reflection of two-dimensional stress waves from free boundaries, and internal phenomena due to stress wave interactions. Author (GRA)

N73-20924# California Univ., Berkeley. Dept. of Mechanical Engineering.
ON THE DERIVATION OF SHELL THEORIES BY DIRECT APPROACH
A. E. Green (Oxford Univ.) and P. M. Naghdi Dec. 1972 19 p refs
(Contract N00014-69-A-0200-1008; NR Proj. 064-436)
(AD-754803; AM-72-6) Avail: NTIS CSCL 20/11

A constrained theory of shells by a direct approach, based on a general theory of a Cosserat surface, is derived and its relation to other recent developments obtained by direct procedures is indicated. Author (GRA)

N73-20925# Watervliet Arsenal, N.Y.
COLUMN INSTABILITY UNDER NONCONSERVATIVE FORCES, WITH INTERNAL AND EXTERNAL DAMPING: FINITE ELEMENT USING ADJOINT VARIATIONAL PRINCIPLES
Julian J. Wu Nov. 1972 39 p refs
(DA Proj. 1F0-61102-A-35D)
(AD-755101; WVT-7262) Avail: NTIS CSCL 20/11

In conjunction with adjoint variational principles, two classical problems of elastic stability under nonconservative forces and under the internal and external damping are studied using the finite element technique. The solutions are formulated in the framework of Rayleigh-Ritz method. It is demonstrated that this approach is very effective for solutions of complicated nonconservative stability problems. The destabilizing effect of Ziegler due to internal damping, the extreme sensitive nature of stabilizing or destabilizing effects for very small internal or external damping parameters and for other ranges of such effects of practical interest have been obtained for these two problems and are presented in several sets of curves. Author (GRA)

N73-20926# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DISTINGUISHING BETWEEN RESISTANCE TO CRACK NUCLEATION AND RESISTANCE TO CRACK PROPAGA-

TION
O. N. Romaniv 5 Jan. 1973 11 p refs Transl. into ENGLISH from Fiz.-Khim. Mech. Mater. (USSR), v. 7, no. 4, 1971 p 102-104
(AF Proj. 7351)
(AD-754620; FTD-HT-23-1529-72) Avail: NTIS CSCL 20/11

The purpose of the present work is to turn attention to the possible errors when evaluating the condition of crack nucleation and the condition of crack propagation stemming from the formal separation of impact ductility into components. Experimental data are obtained with samples of 37KhNZA steel. GRA

N73-20927# Wisconsin Univ., Madison.
DISCRETE BARS, CONDUCTIVE HEAT TRANSFER, AND ELASTICITY
Donald Greenspan and Sandie Turner Jones Nov. 1972 33 p refs
(PB-213060; WIS-CS-72-164) Avail: NTIS HC $3.00 CSCL 20K

Heat transfer and elasticity are modelled from a discrete point of view. Computer examples using bars are given to show the feasibility of the models. The dynamical equations are discrete and energy conserving. Author (GRA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N73-20928 National Lending Library for Science and Technology, Boston Spa (England).
HEAT TRANSFER IN LAMINAR FLOW THROUGH PIPES WITH ANNULAR SPACE
K. Murakawa Nov. 1972 16 p refs Transl. into ENGLISH from Nippon Kikai Gakkai Ronbunshu (Japan), v. 88, no. 19, 1953 p 15-19
(NLL-RTS-7525) Avail: Natl. Lending Library, Boston Spa, Eng.: £1.50; 5 NLL photocopy coupons

A theoretical study, using Laplace transformation and Volterra's integral equation, was made to find the boundary conditions of laminar flow through concentric pipes with annular space. Temperature distribution, heat transfer, and flow velocity were determined. E.H.W.

N73-20929 National Lending Library for Science and Technology, Boston Spa (England).
CALCULATING THE TEMPERATURE FIELDS IN BODIES USING MEANING COEFFICIENTS K SUB 2 AND K SUB 3
L. A. Brovkin and S. I. Devochkina [1972] 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), v. 7, 1972 p 154-156
(NLL-M-21522-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Meaning coefficients K sub 2 = f(Bi, m, n) and K sub 3 = f (Bi, m, n) for the heat flows and temperature fields were found. These coefficients can be used in the engineering method of calculating the temperature fields in bodies with varying thermal and physical coefficients for III order boundary conditions. Author

N73-20930 National Lending Library for Science and Technology, Boston Spa (England).
HEAT TRANSFER AND FRICTIONAL RESISTANCE IN THE TURBULENT FLOW OF HIGH TEMPERATURE GASES IN A PIPE WITH COLD WALLS
P. Yu. Valatkyavichyus, A. A. Zhukauskas, and A. B. Ambrazyavichyus Nov. 1972 9 p refs Transl. into ENGLISH from Lietuvos TSR Mokslu Akad. Darbai: Ser. B (Vilnius), V. 4, no. 67, 1971 p 127-133
(NLL-RTS-7640) Avail: Natl. Lending Library, Boston Spa, Engl.: L0.80; 3 NLL photocopy coupons

Heat transfer and frictional resistance in pipes with cooled walls during the flow of gas with thermophysical properties was investigated over a wide range of mass flow temperatures, using the generally accepted procedures in the Nusselt and Prandtl numbers. Results are summarized in graphs which show: local heat transfer in turbulent gas flow in a tube for different distances from the entry, local heat transfer in different treatments, heat transfer as a function of temperature and enthalpy, and frictional resistance in turbulent flow of gas in tubes. It is concluded that no influence of temperature on heat transfer or frictional resistance was detected. F.O.S.

N73-20931*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SOLID MEDIUM THERMAL ENGINE Patent Application
James R. Jedlicka, Le Roy. Guist, and Richard M. Beam, inventors (to NASA) Filed 27 Feb. 1973 25 p
(NASA-Case-ARC-10461-1; US-Patent-Appl-SN-336319) Avail: NTIS HC $3.25 CSCL 20M

A thermal engine using a single phase metallic working substance to convert thermal energy directly into mechanical energy is presented. The preferred embodiment of the invention includes a single phase working substance in the form of a cylindrical metallic tube free to rotate about its axis while being subjected to continuous bending moments stressing the body along its axis. The stressing subjects the upper portions of the tube to compression while placing the lower portions under tension as the tube is caused to rotate about its axis. Means are also provided for positioning the tube so that radiant energy is concentrated on that portion of the tube which is under maximum compression. The result is that heat absorbed by this portion causes an imbalance of internal forces which tend to impart a rotational moment to the tube so that is rotates about its axis. NASA

N73-20932*# LTV Aerospace Corp., Hampton, Va.
APPROXIMATE THERMOCHEMICAL TABLES FOR SOME C-H AND C-H-O SPECIES
Gilbert S. Bahn Washington NASA Mar. 1973 248 p refs (Contract NAS1-10900)
(NASA-CR-2178) Avail: NTIS HC $3.00 CSCL 20M

Approximate thermochemical tables are presented for some C-H and C-H-O species and for some ionized species, supplementing the JANAF Thermochemical Tables for application to finite-chemical-kinetics calculations. The approximate tables were prepared by interpolation and extrapolation of limited available data, especially by interpolations over chemical families of species. Original estimations have been smoothed by use of a modification for the CDC-6600 computer of the Lewis Research Center PACI Program which was originally prepared for the IBM-7094 computer Summary graphs for various families show reasonably consistent curvefit values, anchored by properties of existing species in the JANAF tables. Author

N73-20933*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
THE VISC CODE: A USER'S MANUAL
Ken Wilson Washington NASA Mar. 1973 42 p refs (Contract NAS2-6668)
(NASA-CR-2237) Avail: NTIS HC $3.00 CSCL 20M

The VISC code is a computer automated scheme for solving the equations describing the fully coupled viscous, radiating flow at the stagnation-point of a blunt body which may or may not be ablating. The code provides a basis for obtaining prediction of the stagnation-point heating to a body entering any planetary atmosphere at hyperbolic velocities. The code is written in FORTRAN V and is operational on both the Univac 1108 (EXEC 8) system and the CDC 7600 system. The report gives an overview of the VISC code computational logic flow, a description of the input requirements and output results and comments on the practical use of the code. As such the report forms a users manual for operation of the VISC code. Author

N73-20934*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
RADIATIVE COUPLED VISCOUS FLOW WITH MASSIVE BLOWING
Y. S. Chou Washington NASA Mar. 1973 49 p refs (Contract NAS2-6668)

(NASA-CR-2236) Avail: NTIS HC $3.00 CSCL 20M

An analysis of the fully-coupled viscous, radiating flow past an ablating blunt body at hyperbolic entry conditions is presented. A detailed thermodynamics computation, as well as a realistic radiation transport model, is included. A locally nonsimilar approach is employed to solve the conservation equations away from the stagnation point. The validity of the locally nonsimilar approach is demonstrated for some nonablating cases. Sample calculations are made for the typical flight condition of a Jovian entry probe. The effects of the downstream injection of the ablation products of a carbon heat shield on the flux distribution around the body are discussed in detail. It is found that most of the radiative energy is absorbed by the injected carbon gas and dumped into the wake. Author

N73-20935*# Advanced Technology Labs., Inc., Jericho, N.Y.

SWIRLING JET TURBULENT MIXING AND COMBUSTION COMPUTATIONS

Arthur Rubel Washington NASA Mar. 1973 40 p refs

(Contract NASw-2075)

(NASA-CR-2231; ATL-TR-180) Avail: NTIS HC $3.00 CSCL 21B

Computations are presented describing the mixing and combustion of swirling jets in a coaxial stream. It is demonstrated that the boundary layer equations represent the flow reasonably well until reversed flow is imminent. For the range of parameters investigated indications are that the edge velocity has little effect on the behavior of the flow. Furthermore, confining the flow with a constant pressure wall, or impressing a favorable pressure gradient on the coaxial flow, acts to reduce the severity of the centerline adverse pressure gradient created by the swirl decay. A simple scalar eddy viscosity model, including a potential core formulation, is shown to described the behavior of weak swirling flow in the far region but is only in fair agreement with observations in the near region. The effects of swirl on a burning hydrocarbon jet exhausting into a cold coaxial stream are shown to be intensified by the reduction of the density due to combustion. The exhanced mixing properties of high swirl flow produce rapid diffusion of the burning gases into the cold edge flow causing early cessation of the NO producing reactions. Computations show that doubling the initial jet swirl could reduce the NO production by 25 percent. Author

N73-20936*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

SL4 CODE - A USER'S MANUAL

Y. S. Chou Washington NASA Mar. 1973 31 p refs

(Contract NAS2-6668)

(NASA-CR-2235) Avail: NTIS HC $3.00 CSCL 20M

The SL-4 code is a computer automated scheme for solving the equations describing the fully-coupled viscous, radiating flow over the front face of a blunt body which may or may not be ablating. The code provides a basis for obtaining predictions of the surface beating to a body entering any planetary atmosphere at hyperbolic velocities. The code is written in FORTRAN V and is operational on both the Univac 1108 (EXEC 8) system in use at LMSC and the CDC 7600 system in use at the University of California, Berkeley. An overview of the SL-4 code computational logic flow, a description of the input requirements and output results, and comments on the practical use of the code are presented. As such this report forms a users manual for operation of the SL-4 code. Author

N73-20937*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.

THE EFFECT OF NOSE GEOMETRY ON THE AEROTHERMODYNAMIC ENVIRONMENT OF SHUTTLE ENTRY CONFIGURATIONS Aerospace Engineering Report 73001

John J. Bertin, W. R. Martindale (ARO, Inc.), H. Tom Faria, Bruce W. Graumann, M. Kathy Horn, and Gary W. Johnson Jan. 1973 163 p refs

(Contract NAS9-10976)

(NASA-CR-128873) Avail: NTIS HC $10.25 CSCL 20M

The effect was studied of nose geometry on the transition criteria for the windward boundary layer, on the extent of separation, on the heat transfer perturbation due to the canopy, and on the surface pressure and the heat transfer in the separated region. The data for each of these problems is analyzed. A literature review that concentrates on separation and the leeward flow-field is presented. Author

N73-20938*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYSIS OF HEAT TRANSFER FOR A NORMALLY IMPINGING LIQUID-METAL SLOT JET

Robert Siegel Washington Apr. 1973 33 p refs

(NASA-TN-D-7260; E-7222) Avail: NTIS HC $3.00 CSCL 20M

A two-dimensional liquid-metal slot jet that is impinging normally against a uniformly heated flat plate is analyzed. The distributions of wall temperature and heat-transfer coefficient are obtained as functions of position along the plate. The liquid-metal assumptions are made that the jet is inviscid and that molecular condition is dominating heat diffusion. The solution is obtained by mapping the jet flow region into a potential plane where it occupies a strip of uniform width. The energy equation is transformed into potential coordinates, and an exact solution obtained in the strip region. Conformal mapping is then used to transform the solution into the physical plane. Author

N73-20939*# Naval Ordnance Lab., White Oak, Md.

EXPLOSIVES FOR LUNAR SEISMIC PROFILING EXPERIMENT (LSPE) Final Report

29 Jan. 1973 51 p refs

(NASA Order T-558-A)

(NASA-CR-128876) Avail: NTIS HC $4.75 CSCL 19A

Explosive charges of various sizes were investigated for use in lunar seismic studies. Program logistics, and the specifications for procurement of bulk explosives are described. The differential analysis, thermal properties, and detonation velocity measurements on HNS/Teflon 7C 90/10 are reported along with the field tests of the hardware. It is concluded that nearly all large explosive charges crack after fabrication, from aging or thermal shock. The cracks do not affect the safety, or reliability of the explosives. F.O.S.

N73-20940*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF THRUSTER PULSE LENGTH ON THRUSTER-EXHAUST DAMAGE OF S13G WHITE THERMAL CONTROL COATINGS

R. D. Sommers and C. A. Raquet 1973 14 p refs Presented at the 7th JANNAF Plume Technol. Conf., Redstone Arsenal, Ala., 3-5 Apr. 1973

(NASA-TM-X-68213; E-7361) Avail: NTIS HC $3.00 CSCL 21B

Rocket exhaust products which strike thermal control surfaces cause changes in solar absorptance (Alpha Sub s) and thermal emittance (Epsilon) of these surfaces. A study was made of the effect of rocket pulse duration on exhaust damage to S13G white coatings. Two pulse lengths were used - 14 msec and 50 msec. An MMH/N2O4 bipropellant 5-lb thrust rocket was fired into a simulated space environment with a vacuum of 0.00001 torr, a liquid helium temperature enclosure, and solar radiation. The changes in solar absorptance and thermal emittance of S13G white coatings due to rocket exhaust were made in-situ for total firing times of 58 seconds with 14 msec pulses and 223.7 sec with 50 msec pulses. The solar absorptance of S13G increased 25 percent due to 223.7 sec of exposure to 50 msec pulses and the thermal emittance was unaffected. The ratio of Alpha Sub s/Epsilon therefore increased by 25 percent. The short 14 msec pulse exhaust exposure caused between 40 and 70 percent increase in solar absorptance and a decrease of between 13 and 18 percent in thermal emittance. The corresponding increase in Alpha Sub s/Epsilon ratio was between 80 and 100 percent. Ultraviolet radiation was present in the short pulse test and may have contributed to the large damage of that test. Author

N73-20941*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXHAUST PLUME AND CONTAMINATION CHARACTERISTICS OF A BIPROPELLANT (MMH/N2O4) RCS THRUSTER

Ernie W. Spisz, Robert L. Bowman, and John R. Jack 1973 26 p refs Presented at the 7th JANNAF Plume Technol. Conf., Redstone Arsenal, Ala., 3-5 Apr. 1973

(NASA-TM-X-68212) Avail: NTIS HC $3.50 CSCL 21B

Results are presented for three recent tests in a series of thruster contamination experiments made in liquid helium-cooled environmental facility. The contaminating effects encountered on various materials, surfaces, and components, due to the exhaust products from a 5-pound thrust, bipropellant (MMH/N2O4) thruster are investigated. The angular distribution of plume effects around the periphery of the thruster established by transmittance changes of quartz samples over the wavelength range from 0.2 to 2.0 micrometer is studied, along with mass deposition rates at a specific location measured with a quartz crystal microbalance for three different experiments. Quadrupole mass spectrometer measurements of the exhaust products over the mass number range from 12 to 75; infrared transmittance measurements of contaminated samples for the wavelength range from 2.5 to 15 microns; and infrared transmittance measurements of residue from the thruster nozzle are also considered. Author

N73-20942*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF CONTAMINATION ON THE OPTICAL PROPERTIES OF TRANSMITTING AND REFLECTING MATERIALS EXPOSED TO A MMH/N204 ROCKET EXHAUST

Robert L. Bowman, Ernie W. Spisz, and John R. Jack Apr. 1973 12 p refs Presented at the 7th JANNAF Plume Technol. Conf., Restone Arsenal, Ala., 3-5 Apr. 1973

(NASA-TM-X-68204; E-7373) Avail: NTIS HC $3.00 CSCL 21B

The changes are presented in spectral transmittance, and reflectance due to exposure of various optical materials to the exhaust plume of a 5-pound thrust bipropellant rocket. The engine was fired in a pulsed mode for a total exposure of 223.7 second. Spectral optical properties were measured in air before and after exposure to the exhaust plume in vacuum. The contaminating layer resulted in both absorption and scattering effects which caused changes as large as 30-50% for transmitting elements and 15% for mirrors in the near ultraviolet wavelengths. The changes in spectral properties of materials exposed to the exhaust plume for 44 and 223.7 seconds are compared and found to be similar. Author

N73-20943*# Linguistic Systems, Inc., Cambridge, Mass.

DETERMINATION OF THE HEAT EXCHANGE COEFFICIENT IN TURBULENT FLOWING WATER

C. Boutelier, J. Colin, and J. Timbal Washington NASA Apr. 1973 8 p refs Transl. into ENGLISH from J. Physiol. (Paris), v. 63, May 1971 p 207-209

(Contract NASw-2482)

(NASA-TT-F-14867) Avail: NTIS HC $3.00 CSCL 20M

Subjects were immersed for 80 to 180 minutes in constant-temperature moving water to determine the heat loss by convection from the body. A mean was found of 53.3 + or - 0.8 KCal sq mhc, a value which is in good agreement with results obtained by other authors. Author

N73-20944*# Linguistic Systems, Inc., Cambridge, Mass.

PROBLEMS OF SUMMER ROOM HEATING

K. Gertis Washington NASA Apr. 1973 6 p Transl. into ENGLISH from "Beispiele Angew. Forsch., Jahrbuch 1968-69" Stuttgart, Jun. 1969 p 60-69

(Contract NASw-2482)

(NASA-TT-F-14849) Avail: NTIS HC $3.00 CSCL 20M

Modern buildings have large window glass surfaces and in summertime, depending on glass type and wall material, room temperatures can become intolerable. Suitable building materials for inner rooms are recommended rather than expensive air conditioning systems. Author

N73-20945# Advisory Group for Aerospace Research and Development, Paris (France).

HEAT-TRANSFER MEASUREMENTS IN SHORT-DURATION HYPERSONIC FACILITIES

D. L. Schultz (Oxford Univ.) and T. V. Jones (Oxford Univ.) Feb. 1973 155 p refs

(AGARD-AG-165; AGARDograph-165) Avail: NTIS HC $9.75

The techniques for making measurements of heat transfer in short duration and rapidly varying flows are reviewed. Methods discussed include: gauges operating on the semi-infinite principle, calorimeter gauges, pyroelectric heat transfer gauges, measurement of radiative heat transfer, and optical methods. The error in deduced heat transfer rate arising from a surface temperature discontinuity due to the presence of an isolated heat transfer gauge is also discussed. F.O.S.

N73-20946# Princeton Univ., N.J. Gas Dynamics Lab.

AN EXPERIMENTAL INVESTIGATION OF LAMINAR HEAT TRANSFER TO CONES AT HYPERSONIC SPEEDS

Carl T. Berry, Irwin E. Vas, and Seymour M. Bogdonoff Wright-Patterson AFB, Ohio ARL Nov. 1972 100 p refs (Contracts F33615-67-C-1065; F33615-70-C-1244; AF Proj. 7064)

(AD-754056; ARL-72-0159) Avail: NTIS CSCL 16/2

The present study was an experimental investigation of the laminar surface heat transfer distribution about cones. The study was conducted in the Princeton University hypersonic nitrogen facility and covered a wide range of geometries and test conditions in an attempt to evaluate the numerical accuracy, theoretical modeling, and range of applicability of the several theories which are available. Cones, varying from 3 degrees to 30 degrees, with two nose bluntnesses, and lengths from one to eight inches were examined over a range of test conditions: Mach numbers from 16 to 25, and unit Reynolds numbers from 7,000 to 40,000 per inch. The detailed heat transfer distributions, covering the full range of nose dominated, merged, and weak interaction regimes, were compared with several theoretical prediction techniques. A critical review of the modeling involved in the theories, as compared to the experiments, is presented.

Author (GRA)

N73-20947# Army Foreign Science and Technology Center, Charlottesville, Va.

AN APPROXIMATE METHOD FOR SOLVING THE ONE DIMENSIONAL PROBLEMS OF THERMAL CONDUCTIVITY

L. F. Vozyuk and Yu. T. Krivenchuk 22 Jun. 1972 10 p refs Transl. into ENGLISH from Mat. Fiz. (USSR), no. 7, 1970 p 39-44

(AD-754255; FSTC-HT-23-795-72) Avail: NTIS CSCL 20/13

The paper describes an approximate method for solving the first boundary value problem of thermal conductivity. The method involves a reduction of the original problem to an auxiliary Cauchy problem which is then solved by applying the Laplace transform and the method of power series. The solution is compared with known solutions to the first boundary problem, showing that this approximate method is sufficiently effective when the equation of thermal conductivity contains variable coefficients.

Author (GRA)

N73-20948# California Univ., Berkeley. Dept. of Mechanical Engineering.

ON THERMAL EFFECTS IN A SPECIAL CLASS OF VISCOELASTIC FLUIDS

M. J. Crochet and P. M. Naghdi Nov. 1972 34 p refs Prepared in cooperation with Louvain Univ., Belgium

(Contract N00014-69-A-0200-1008)

(AD-754802; AM-72-5) Avail: NTIS CSCL 20/11

A brief account is given of a non-isothermal theory of a restricted class of viscoelastic fluids with fading memory followed by its application to some special viscometric flow.

Author (GRA)

N73-20949*# Naval Ordnance Lab., White Oak, Md.

THE DEVELOPMENT OF AN INERT SIMULANT FOR HNS/TEFLON EXPLOSIVE

Wayne L. Elban 14 Nov. 1972 30 p refs Sponsored by NASA

(NOL Proj. 998/NASA)

(NASA-CR-131370; AD-754392; NOLTR-72-255) Avail: NTIS HC $3.50 CSCL 19/1

The report describes the development and evaluation of an inert simulant for the thermally stable, heat-resistant plastic-bonded explosive HNS/Teflon. The simulant is made by dry blending vinylidene fluoride, melamine and Teflon which when compared has a pressed density and thermal properties corresponding closely to the explosive. In addition, the machinability and handling characteristics of the simulant are similar to the explosive. Author (GRA)

N73-20950# Army Foreign Science and Technology Center, Charlottesville, Va.
NUMERICAL SOLUTIONS FOR PROBLEMS OF HEAT TRANSFER IN A SYSTEM OF SOLIDS WITH MOVING BOUNDARIES AND IN A STREAM OF VISCOUS LIQUIDS
N. I. Nikitenko 31 Oct. 1972 10 p refs Transl. into ENGLISH from Teplo- i Massoperenos (Minsk), v. 8, 1968
(AD-754639; FSTC-HT-23-1018-72) Avail: NTIS CSCL 20/13

An examination of a system of equations and its different types of boundary and initial conditions that describe the process of heat transfer in systems of solids with movable boundaries is conducted, and a difference method (and its convergence conditions) to solve the spatial problem is introduced and applied to the nonstationary Navier-Stokes equations for a compressible fluid. Author (GRA)

N73-20951# Wisconsin Univ., Madison. Mathematics Research Center.
A NONEXISTENCE THEOREM FOR THE HEAT EQUATION WITH A NONLINEAR BOUNDARY CONDITION AND FOR THE POROUS MEDIUM EQUATION BACKWARD IN TIME Technical Summary Report
Howard A. Levine and Lawrence E. Payne Dec. 1972 24 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-755073; MRC-TSR-1296) Avail: NTIS CSCL 20/13

The paper deals with two nonlinear problems for parabolic equations. The first, problem A, is an initial-boundary value problem for the heat equation where the nonlinearity is in the boundary condition. The second, problem B, is a final value problem for the porous medium equation. It is shown that if the nonlinearity and initial data in A satisfy certain restrictions then no classical (or weak) solution of A can exist for all time. It is further shown that no weak solution of B can have existed for all previous time. An indication is given of how the methods used in A can be used to obtain (under reasonable hypotheses) the same type of nonexistence result for nonlinear problems associated with certain systems of parabolic and hyperbolic equations. Author (GRA)

N73-20952# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN PROBLEMS IN THE STABILIZATION OF A FLAT DIFFUSION FLAME
M. A. Kondak, V. N. Kryzhanovskii, and V. S. Stolyar 13 Dec. 1972 14 p refs Transl. into ENGLISH from Vestn. Kiev. Politekh. Inst., Ser. Teploenerg. (Kiev), no. 7, 1970 p 91-96
(FTD Proj. T71-04-03)
(AD-754049; FTD-MT-24-1496-72) Avail: NTIS CSCL 13/2

Results are presented from studies of linear stabilization of a flat diffusion gas flame, as well as data on the influence of various factors on the separation characteristics of linear stabilizers. Linear stabilizers have practically unlimited range of operation with respect to air excess factor and provide a near kinetic combustion process. The principle of linear stabilization can be used to develop effective gas burners and combustion chambers for gas turbines. Author (GRA)

N73-20953# California Univ., Riverside. Dept. of Mathematics.
ANALYTIC CHARACTERIZATIONS OF HEAT AND THERMAL CONDUCTIVITY Final Scientific Report, 1 Aug. 1971 - 31 Oct. 1972
Victor L. Shapiro 31 Oct. 1972 13 p refs
(Grant AF-AFOSR-2046-71; AF Proj. 9749)
(AD-754995; AFOSR-73-0022TR) Avail: NTIS CSCL 12/1

The main part of the report consists of a description of the following five research papers: Capacity and the nonlinear Navier-Stokes equations; Algebraic integers and distributions on the N-torus; Capacity and the absolute Abel summability of multiple Fourier series; Regularity for solutions of the nonlinear stationary Navier-Stokes equations; Isolated singularities for solutions of the non-linear stationary Navier-Stokes equations. In particular, in these papers, new, basic and fundamental results were obtained in the area of The Mathematical Theory of Viscous Incompressible Flow. Author (GRA)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N73-20954*# IIT Research Inst., Chicago, Ill.
MISSION OBJECTIVES AND TRAJECTORIES Final Report, Nov. 1971 - Jan. 1973
Jan. 1973 70 p refs
(Contract NASw-2144)
(NASA-CR-131395; A-11) Avail: NTIS HC $5.50 CSCL 05B

The present state of the knowledge of asteroids was assessed to identify mission and target priorities for planning asteroidal flights in the 1980's and beyond. Mission objectives, mission analysis, trajectory studies, and cost analysis are discussed. A bibliography of reports and technical memoranda is included. F.O.S.

N73-20955# Deutsche Gesellschaft fuer Luft- und Raumfahrt, Porz (West Germany).
MANAGEMENT IN SCIENCE AND TECHNOLOGY. PUBLICATION IN HONOR OF THEODOR BENECKE [MANAGEMENT IN WISSENSCHAFT UND TECHNIK. FESTSCHRIFT FUER THEODOR BENECKE]
Sep. 1971 295 p refs In GERMAN; partly in ENGLISH and ITALIAN
Avail: NTIS HC $16.75

A historical review on organizational developments of the German aeronautical societies is followed by a description of management methods for modern aerospace research facilities. For individual titles, see N73-20956 through N73-20969.

N73-20956 Deutsche Gesellschaft fuer Luft- und Raumfahrt, Porz (West Germany).
ON THE MANAGEMENT OF GERMAN AEROTECHNOLOGY DURING THE FIRST HALF CENTURY 1900 TO 1945 [VON DER FUEHRUNG DER DEUTSCHEN LUFTFAHRTTECHNIK IM ERSTEN HALBEN JAHRHUNDERT 1900 - 1945]
Adolf Baeumker *In its* Management in Sci. and Technol. Sep. 1971 p 20-43 In GERMAN (For availability see N73-20955 11-34)

German aeronautical development during the first half of the century is characterized by: (1) The discovery or pioneer period from 1900 to 1941; (2) operational warfare from 1918 to 1941; (3) air traffic and glider development from 1923 to 1932; and (5) warfare, collapse, and destruction from 1940 to 1945. Transl. by G.G.

N73-20957 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Troisdorf-spich (West Germany).
FROM THE WGL TO THE DGLR: ON SIXTY YEARS OF WORK FOR AERONAUTICS [VON DER WGL ZUR DGLR: AUS SECHS JAHRZEHNTEN TAETIGKEIT FUER DIE LUFTFAHRT]
Werner Schulz *In its* Management in Sci. and Technol. Sep. 1971 p 44-71 In GERMAN (For availability see N73-20955 11-34)

The scientific career of Dr. Theodor Benecke is briefly outlined. Technical and scientific contributions of the German aeronautical societies to aerospace sciences and organizations are described. Transl. by G.G.

N73-20958 Deutsche Botschaft, London (England).
INTERNATIONAL SCIENTIFIC COOPERATION WITH AGARD [INTERNATIONALE WISSENSHAFTLICHE ZUSAMMENARBEIT IM RAHMEN DER AGARD]
Rudolf Schrader *In* DFVRL Management in Sci. and Technol. Sep. 1971 p 73-79 In GERMAN (For availability see N73-20955 11-34)

The activities of Dr. Theodor Benecke as official representative for aeronautical research at the German Department of Defense in cooperation with AGARD are described. Work sessions covered problems of aerospace medicine, avionics, propagation of electromagnetic waves, flow dynamics, propulsion and energy,

structures and materials, and guidance and control.
Transl. by G.G.

N73-20959 Advisory Group for Aerospace Research and Development, Paris (France).
AGARD-GERMAN COOPERATION
Frank Wattendorf *In* DFVLR Management in Sci. and Technol. Sep. 1971 p 80-87 (For availability see N73-20955 11-34)

Dr. Theodor Benecke's activities and accomplishments as Chairman of the Advisory Group for Aerospace Research and Development at AGARD - NATO are described. Typical cooperation projects for mutual benefit constituted development of V/STOL aircraft; low altitude defense; Transall; G 91; F 104 G; and the German-French Research Institute at St. Louis, France. G.G.

N73-20960 National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).
SOME GUIDELINES ON DIRECTION, MANAGEMENT, AND ACTIVITIES OF THE NLR [EINIGE HAUPTLINIEN VON LEITUNG, MANAGEMENT UND TAETIGKEITSFELD DER NATIONALEN LUFT-UND RAUMFAHRTVERSUCHSANSTALT IN DEN NIEDERLANDEN]
Hendricus I. VanderMaas and Anthonie Marx *In* DFVLR Management in Sci. and Technol. Sep. 1971 p 88-113 In GERMAN (For availability see N73-20955 11-34)

Organization, management, and activities at the National Institute for Aerospace Research of the Netherlands are reported. Scientific projects consider the development of lightweight aircraft configurations with good aerodynamic properties for civilian as well as military applications. Technological research is limited to guidance and control of rockets, systems analyses, materials and construction for aerospace environments, and space simulation. Cooperation of the institute with AGARD members contributes to general scientific and technical aerospace developments.
Transl. by G.G.

N73-20961 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Aachen (West Germany).
MISSION AND ORGANIZATION OF THE DFVLR: TWO YEARS OF INTEGRATED SOCIETY OF GERMAN AERONAUTICAL AND SPACE FLIGHT RESEARCH [UEBER DIE AUFGABE UND DIE ORGANISATION DER DFVLR: ZWEI JAHRE EINHEITSGESELLSHAFT DER DEUTSCHEN LUFT-UND RAUMFAHRTFORSCHUNG]
Volker Aschoff *In its* Management in Sci. and Technol. Sep. 1971 p 114-146 In GERMAN (For availability see N73-20955 11-34)

The development history of the German Society for Aerospace Research is outlined and its scientific and geographic organizations are described. The various institutes of the society are assigned individual research on flow mechanics; flight mechanics and control; materials and construction; propulsion and energy; electronics; and aerospace physics, simulation, and medicine.
Transl. by G.G.

N73-20962 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
SOME THOUGHTS ON RESEARCH MANAGEMENT TODAY [EINIGE GEDANKEN ZUR FORSCHUNGSFUEHRUNG HEUTE]
Karl Doetsch *In its* Management in Sci. and Technol. Sep. 1971 p 147-161 refs In GERMAN (For availability see N73-20955 11-34)

Successful organizational management of a large research institute requires the cooperation between scientists and administration personnel. The institute director contributes to the selection and assignment of scientific personnel, initiates and supports additional training, improves the working environment, and furthers scientific exchanges between the institute and other research centers. One of the most difficult problems constitutes funding and the distribution of moneys available. Transl. by G.G.

N73-20963 Air Force Systems Command, Washington, D.C.
EFFECTS OF DEFICIENCY IN FUNDING OF RESEARCH AND DEVELOPMENT
Georg E. Knausenberger *In* DFVLR Management in Sci. and Technol. Sep. 1971 p 163-175 refs (For availability see N73-20955 11-34)

Using available statistical data for quantitative reasoning, the expense increase of technological systems due to cuts in research and development funds is broadly argued. Author

N73-20964 Institute for Defense Analyses, Washington, D.C.
COST AND ECONOMIC FACTORS IN AEROSPACE SYSTEM DEVELOPMENT
Alexander H. Flax *In* DFVLR Management in Sci. and Technol. Sep. 1971 p 176-209 refs (For availability see N73-20955 11-34)

The advancement of technology in aerospace systems increases cost of development and production of such systems depending on the rate at which the new technology is introduced. Control of the technology introduction rate and proper assessment of cost and cost uncertainties are important functions of systems management. G.G.

N73-20965 Bundesminister fuer Verteidigung, Bonn (West Germany).
THE MILITARY ENGINEER [DER WEHRINGENIEUR HEUTE]
Guenther Schoener *In* DFVLR Management in Sci. and Technol. Sep. 1971 p 210-218 refs In GERMAN (For availability see N73-20955 11-34)

The training of engineers and scientists for military careers is emphasized and the importance of technical specialists for a modern defense technology is outlined. Transl. by G.G.

N73-20966 Institut Franco-Allemand de Recherches, St. Louis (France).
ON THE IMPORTANCE OF MODERN MANAGEMENT [ZUR BEDEUTUNG DES MODERNEN MANAGEMENTS]
Rudi Schall *In* DFVLR Management in Sci. and Technol. Sep. 1971 p 219-225 refs In GERMAN (For availability see N73-20955 11-34)

Operational management is responsible for technological progress and the productivity and economic growth of a society. The manager is part of the selection process that evaluates new developments and technologies before industralization for their useful and damaging effects. It is concluded that managers form a creative element that influences the future of society.
Transl. by G.G.

N73-20967 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
MANAGEMENT IN RESEARCH [MANAGEMENT IN DER FORSCHUNG]
Heinz Busch *In* DFVLR Management in Sci. and Technol. Sep. 1971 p 226-241 In GERMAN (For availability see N73-20955 11-34)

Management of basic and applied research as basis for technological applications is the crucial factor in economic and social developments. Exact long term planning of research project timetables and costs as well as control and evaluation of required modern management methods are adapted to the special problems involved. Transl. by G.G.

N73-20968 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
FUTURISTIC VIEWPOINTS FOR MANAGING A MAJOR RESEARCH FACILITY [ZUKUNFTSORIENTIERTE GESICHTSPUNKTE BEIM FUEHREN EINER GROSSFORSCHUNGS-EINRICHTUNG (MIT HINWEISEN AUF DIE LUFT- UND RAUMFAHRTFORSCHUNG)]
Manfred Schroeder *In its* Management in Sci. and Technol. Sep. 1971 p 242-256 refs In GERMAN (For availability see N73-20955 11-34)

Advanced automation and the application of modern technologies require close cooperation between research management, university, industry, and government. Successful management of a large research organization considers goal definition, public relations, motivation, education, and co-determination as primary tools. It is suggested that advanced co-determination models are developed that provide input from institute scientists and engineers into the management process and the selection of research projects. Computer and nuclear

technologies are also valuable contributors to technical developments in aerospace research. Transl. by G.G.

N73-20969 Politecnico di Torino (Italy).
OBSERVATIONS ON SOME TECHNICAL ASPECTS OF GUIDED AIR CUSHION VEHICLES [CONSIDERAZIONI SU ALCUNI ASPETTI TECNICI DEI VEICOLI, GUIDATI A CUSCINO D'ARIA]
Guiseppe Gabrielli *In* DFVLR Management in Sci and Technol. Sep. 1971 p 258-276 refs In ITALIAN (For availability see N73-20955 11-34)

Controllable air cushion vehicle technology is considered for passenger transports over short and medium long distances in connection with existing transportation media. Special attention is given to specific workloads, relationships to optimal speed, payload profits, and propulsion group systems. Transl. by G.G.

N73-20970# Committee on Interstate and Foreign Commerce (U. S. House).
AIR PASSENGER FEES - STATE AND LOCAL CHARGES
Washington GPO 1972 200 p refs Hearings on H.R. 2337, H.R. 14847, and H.R. 10326 (and identical bills) before Comm. on Interstate and Foreign Com., 92d Congr., 2d Sess., 19 and 23 Jun. 1972
Avail: Subcomm. on Transportation and Aeron.

Testimony related to the government's role in regulating the operations of civil aviation is presented. Reference is made to proposed legislation dealing with state taxation and the Federal share of funds to be used for airport construction, maintenance, and improvement. These hearings, which include consideration of present and proposed air passenger fees, took place on 19 June and 23 June, 1972. J.M.M.

N73-20971# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
LIST OF DLR-FORSCHUNGSBERICHTE, DLR-MITTEILUNGEN AND DFVLR-SONDERDRUCKE FROM THE YEAR 1972
1972 64 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-73-01) Avail: NTIS HC $5.25; DEVLR Porz: 2,40 DM

A listing of German research reports which have been published in the German Air and Space Travel series in 1972. A list of reports published by German scientists in journals and other publications is included. Author

N73-20972*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD FOR TREATMENT OF WATER CONTAINING LOW CONCENTRATIONS OF MERCURY
Dennis J. Flood and Gerald J. Kraynik Washington Mar. 1973 7 p refs
(NASA-TM-X-2764; E-7309) Avail: NTIS HC $3.00 CSCL 07D

A process employing magnetic filtering techniques has been devised for treating water containing concentrations on the order of 1 microgram/cubic centimeter of atomic or ionic mercury. A laboratory-scale system has been operated and can reduce the mercury content of test solutions by as much as 90 percent. Author

N73-20973# Advisory Group for Aerospace Research and Development, Paris (France).
AGARD INDEX OF PUBLICATIONS, 1952 - 1970. PART 1: ABSTRACT SECTION
Jun. 1972 474 p refs
(AGARD-Index-52/70-Pt-1) Avail: NTIS HC $25.75

Abstracts of advisory reports, scientific reports, AGARDographs, conference proceedings, and miscellaneous publications are presented. F.O.S.

N73-20974# Advisory Group for Aerospace Research and Development, Paris (France).
AGARD INDEX OF PUBLICATIONS, 1952 - 1970. PART 2: SUBJECT INDEX
Oct. 1972 190 p refs
(AGARD-Index-52/70-Pt-2) Avail: NTIS HC $11.50
For abstract, see N73-20973

N73-20975# National Aeronautics and Space Council, Washington, D.C.
AERONAUTICS AND SPACE REPORT OF THE PRESIDENT: 1972 ACTIVITIES
1972 103 p
Avail: SOD $1.25 domestic postpaid or $1.00 GPO Bookstore

The progress and activities of the American space effort are described. Detailed information is provided on specific development in the Apollo and Skylab programs, as well as on future missions involving the cooperation of the Soviet Union and Western European countries. Details on research and development in the supporting and cooperative sciences are also included. J.M.M.

N73-20976# Committee on Commerce (U. S. Senate).
ENERGY RESEARCH AND DEVELOPMENT
Washington GPO 1972 380 p refs Hearings on Amendment 364 to S. 1684 before Comm. on Com., 92d Congr., 2d Sess., 15-16 Mar. 1972
Avail: Comm. on Com.

Senate hearings on the research and development of electric power production and related industries are reported. The objectives are to survey the need for and to appraise the workability of a Federal power research and development program and to assist private industry in ecologically constructive efforts to guarantee the present and future power needs of the U.S. J.M.M.

N73-20977*# Midwest Research Inst., Kansas City, Mo.
ECONOMIC IMPACT OF STIMULATED TECHNOLOGICAL ACTIVITY Final Summary Report, 7 Apr. 1970 - 15 Oct. 1971
22 Nov. 1971 50 p
(Contract NASw-2030; MRI Proj. 3430-D)
(NASA-CR-131289) Avail: NTIS HC $4.50 CSCL 05C

The findings are reported of research into the relationships between technological progress and economic development, with emphasis on several ways in which NASA research and development has aided in the accumulation and commercial application of new or improved scientific and technological knowledge. Author

N73-20978# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE - SCIENTIFIC AFFAIRS, NO. 311
30 Mar. 1973 34 p refs Transl. into ENGLISH from various Eastern European periodicals
(JPRS-58615) Avail: NTIS HC $3.75

Articles are presented concerning the development and progress in the various theoretical and applied scientific disciplines and technical fields; and the administration, structure, personnel, and research plans of leading East European scientific organizations and institutions, particularly the academies of sciences. Author

N73-20979# Science Research Council, London (England).
[SCIENCE RESEARCH COUNCIL REPORT FOR 1971 - 1972, INCLUDING ASTRONOMY, SPACE, AND RADIO AND NUCLEAR PHYSICS RESEARCH]
Sep. 1972 106 p refs
(NP-19468) Avail: AEC Depository Libraries; HMSO 73p; PHI $3.15

The several fields of science research supported by the Council are dealt with in sections: organization, administration, finance, postgraduate training awards and research grants; astronomy, space and radio (including radio astronomy, cosmic rays and gravitational radiation, and programs of the Astrophysics Research Unit in solar physics, laboratory astrophysics and UV astronomy, atomic and plasma physics); engineering, nuclear physics (high energy physics programs based on accelerators, particularly the CERN, Nimrod and NINA accelerators, cosmic rays, nuclear structure, theoretical physics); other subjects, including biology, chemistry, mathematics, neutron beam research, physics, and Atlas Computer Laboratory. NSA

N73-20980# Army Foreign Science and Technology Center, Charlottesville, Va.

ANTIAIRCRAFT DEFENSE HERALD, NO. 6, JUNE 1972
11 Dec. 1972 165 p refs Transl. into ENGLISH from Vestnik Protivovozdushnoi Oborony (USSR), no. 6, Jun. 1972 p 1-97
(AD-754834; FSTC-HT-23-1050-73) Avail: NTIS CSCL 15/3

Articles from the Russian Monthly Magazine of the Antiaircraft Defense Force are translated. These articles were written by military personnel in reference to military training, combat readiness and antiaircraft defense systems. GRA

N73-20981# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
BALLISTIC NOMOGRAPHS Final Report
Carl O. Reitz 11 Dec. 1972 20 p refs
(AD-754428; NADC-72187-VT) Avail: NTIS CSCL 15/7

The report describes the use and development of a group of nomographs to predict the aerodynamic performance of air launched stores with single stage decelerator systems. Given the store release altitude and either its terminal velocity or ballistic coefficient, the nomographs indicate the time of fall and drift under a specified wind profile. Author (GRA)

N73-20982# Informatics, Inc., Rockville, Md.
SELECTED MATERIAL FROM SOVIET TECHNICAL LITERATURE, NOVEMBER 1972
Stuart G. Hibben 5 Jan. 1973 148 p refs
(Contract F44620-72-C-0053; ARPA Order 1622-3)
(AD-754946; AFOSR-73-0035TR) Avail: NTIS CSCL 05/2

The report includes abstracts and bibliographic lists on major contractual subjects that were completed in November, 1972. The major topics are: laser technology, effects of strong explosions, geosciences, and particle beams. Sections on material science and on items of miscellaneous interest are included. The No. 2 Report on Soviet Geothermal Engineering has been published under separate cover as an additional optional topic - AD-754947. To avoid duplication in reporting, only laser entries concerning high-power effects are routinely included, since all current laser material appears regularly in the quarterly bibliographies. An index identifying source abbreviations and an author index to the abstracts are appended. Author (GRA)

N73-20983# Army Foreign Science and Technology Center, Charlottesville, Va.
COMBAT GUIDED MISSILES
Aleksander Nikolayevich Latukhin 29 Nov. 1972 102 p refs Transl. into ENGLISH of the publ. "Boevoe Upravlyaemye Rakety" Moscow, Voyenizadt, 1968
(AD-754629; FSTC-HT-23-1885-72) Avail: NTIS CSCL 16/4

A survey of all classes of guided missiles, from wire-controlled anti-tank missiles to ICBM's. Descriptions of typical Western missiles of each class, almost all from the United States. All data taken from published Western sources. A generally realistic and factual appraisal at the semi-popular level, covers technical characteristics, handling procedures, positive and negative points, and effects on tactics and strategy. Author (GRA)

N73-20984# Army Behavior and Systems Research Lab., Arlington, Va.
EVALUATION OF SELECTED PICTORIAL CHARACTERISTICS OF REFERENCE MATERIALS FOR USE IN IMAGE INTERPRETATION
Marshall A. Narva Nov. 1972 83 p refs
(DA Proj. 2O6-62704-A-721)
(AD-754567; BESRL-TRN-233) Avail: NTIS CSCL 14/5

The present Technical Research Note reports on three related experiments conducted by the BESRL Work Unit Influence of Displays on Image Interpreter Performance to investigate the characteristics of pictorial content of reference materials (keys) used by image interpreters with a view to determining the most effective way of representing objects in the key. The set of experiments was concerned with obtaining information pertaining to the optimal manner of presenting recognition features in a key so as to aid an interpreter in final identification of an object seen in imagery. Each experiment involved different combinations of the characteristics under study--(1) type of presentation (use of photographs or outline drawings, or both), (2) viewing angle (certical, oblique, or both), and (3) scale of the image in the key (large or small). In the first experiment, computer-aided procedures for selecting the category of the object imaged were included. In experiments two and three, no computer aids were employed. The interpreter used only the key which contained no textual material. In each experiment, recently graduated image interpreters identified a series of 16 vehicles organized into four sets and presented in a balanced research design. Two levels of quality were used in the test imagery. Author (GRA)

N73-20985# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES, VOLUME 26, NO. 12
John M. Leonard and Victoria Hewitson 29 Dec. 1972 30 p refs
(AD-754406) Avail: NTIS CSCL 05/2

Brief articles concerning recent developments in European scientific research are presented. Articles in the following areas are included: aerospace, behavioral sciences, chemistry, ocean science, and physical science. F.O.S.

N73-20986# Naval Undersea Center, San Diego, Calif. Ocean Technology Dept.
THE FLOATING STABLE PLATFORM: TRANSFERRING NAVY TECHNOLOGY TO CIVILIAN APPLICATIONS
Howard R. Talkington Dec. 1972 18 p refs
(AD-754783; NUC-TP-335) Avail: NTIS CSCL 13/10

The Navy has conducted research and development on the concept of using floating stable platforms for combatant missions. Much of the technological data developed is directly applicable to solutions for civilian problem areas, such as offshore floating airports, nuclear power generating plants, construction support bases, industrial sites, trans-shipping terminals, and water processing plants. The report discusses the technology developed by the Navy, and describes several applications when the transfer of this technology to civilian applications can benefit contemporary society. Author (GRA)

N73-20987# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
PULLER TAPE EVALUATION
John A. Hincks Nov. 1972 22 p
(AF Proj. 72-28-C-6-1)
(AD-754925; DSPS-72-7) Avail: NTIS CSCL 17/4

A series of tests was conducted on Demac Corp. (Mystik Tape) and Lundy, Inc. (source of tape supplied to Lundy unknown) Puller tapes currently in military use. Author (GRA)

N73-20988# Informatics, Inc., Rockville, Md.
SELECTED MATERIAL FROM SOVIET TECHNICAL LITERATURE, OCTOBER 1972 Interim Report
Stuart G. Hibben 15 Dec. 1971 196 p refs
(Contract F44620-72-C-0053; ARPA Order 1622-3)
(AD-754962; AFOSR-73-0033TR) Avail: NTIS CSCL 05/2

The report includes abstracts and bibliographic lists on major contractual subjects that were completed in October, 1972. The major topics are: laser technology, effects of strong explosions, geosciences, and particle beams. Sections on material science and a biocybernetics bibliography have been included. To avoid duplication in reporting, only laser entries concerning high-power effects are routinely included, since all current laser material appears regularly in the quarterly bibliographies. An index identifying source abbreviations and an author index to the abstracts are appended. Author (GRA)

N73-20989# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
GUIDE TO THE LITERATURE OF ENGINEERING, MATHEMATICS, AND THE PHYSICAL SCIENCES, THIRD EDITION
Sylvia Weiser Aug. 1972 216 p refs
(Contract N00017-72-C-4401)
(AD-754382; APL-TG-230-B3) Avail: NTIS CSCL 05/2

The report presents a selected bibliography that emphasizes the areas of engineering, mathematics, and science, that are of primary importance to Applied Physics Laboratory staff members. Author (GRA)

N73-20990# Coverdale and Colpitts, New York.
LOGAN AIRPORT TRAVEL STUDY Final Report
31 Oct. 1972 124 p refs Sponsored in part by Mass. Dept. of Public Works

(Contract DOT-UT-207)
(PB-212814; UMTA-MA-09-0007-72-1) Avail: NTIS HC $3.00 CSCL 13B

An origin-destination survey was conducted among air travelers, visitors, and employees at Boston's Logan International Airport. The study focused on the air travel market in various geographic areas, the principal modes used for ground travel between these areas and Logan Airport, and the current volume of ground travel by each principal mode used for airport access. Emphasis is placed on the relative attractiveness of rapid transit for ground travel to and from the airport. The data reveal principal concentrations of trip generators, modal split, major travel corridors, and other conclusions. GRA

N73-20991# Mitre Corp., McLean, Va. Transportation Systems Engineering Dept.
US TRANSPORATION: SOME ENERGY AND ENVIRONMENTAL CONSIDERATIONS
W. E. Fraize Sep. 1972 50 p refs
(PB-213034; MITRE-72-164) Avail: NTIS HC $3.75 CSCL 13B

The role of transportation in air pollution and consumption of energy, especially petroleum, is reviewed, with emphasis on the U.S. situation. Both technological and control measures for each problem area are discussed. Technological measures focus on the automobile, high speed ground transportation modes, and non-petroleum fuels, while control measures, which encourage the use of the more efficient transportation modes, are seen to offer significant benefits. The near future is discussed with respect to the impact of the U.S. Amended Clean Air Act of 1970. Transportation evolution over the next few decades is projected. Author (GRA)

N73-20992# Transportation Systems Center, Cambridge, Mass.
COMPUTER MODELING OF TRANSPORTATION GENERATED AIR POLLUTION: A STATE-OF-THE-ART SURVEY Final Report
Eugene M. Darling, Jr. Jun. 1972 132 p refs
(Contract DOT-OS-222)
(PB-213013; DOT-TSC-OST-72-20) Avail: NTIS HC $5.45 CSCL 13B

The state-of-the-art in air pollution modeling is surveyed with particular emphasis on the modeling of dispersion from transportation sources. Models which have actually been implemented are stressed and the computational aspects of these models are treated in detail. Applications are discussed and validations are critically assessed. It was found that Gaussian and conservation of mass models are currently the most widely used tools for analyzing the dispersion of pollutants in the atmosphere. GRA

N73-20993# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS, SEPTEMBER 1972
Sep. 1972 54 p
(PB-212475) Avail: NTIS HC $3.00. Also available on subscription $15.00/year domestic, $18.00/year foreign CSCL 05B

Contents: Measurement of the 1 to 800 Angstrom solar XUV/Flux on March 7, 1970: Chemistry; Communications Sciences; Electricity; Mathematics; Metallurgy; Ocean Sciences; Optical Physics; and Radar. GRA

N73-20994# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
DESCRIPTION AND CRITIQUE OF QUANTITATIVE METHODS FOR THE ALLOCATION OF EXPLORATORY DEVELOPMENT RESOURCES
Charles L. Trozzo May 1972 189 p refs
(Contract DAHC15-67-C-0011)
(AD-753817; P-731; IDA/HQ-72-13903) Avail: NTIS CSCL 05/1

The paper analyzes ten methods for planning the allocation of resources among projects within the exploratory development category of the Defense research, development, test and evaluation program. Each method is described in terms of a general framework of planning methods and of the factors that influence the allocation of development resources. A comparative analysis is made of the relative strengths and weaknesses of these methods. The more quantitative methods are considered complex and difficult to apply. The less quantitative methods, frameworks for recording and transmitting information, are seen as less likely to mislead program management than the more quantitative ones. Consequently, managers may find some one of these to be a convenient framework for organizing the information that they need in deciding the allocation of development resources.
Author (GRA)

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EUROPEAN

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